SCIENCE

VOL. 101 FRIDAY, MARCH 23, 1945 No. 2621

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SCIENCE: A Weekly Journal, since 1900 the official organ of the American Association for the Advancement of Science. Published by the American Association for the Advancement of Science every Friday at Lancaster, Pennsylvania.

Editors: JOSEPHINE OWEN CATTELL and JAQUES CATTELL.

Policy Committee: MALCOLM H. SOULE, ROGER ADAMS and WALTER R. MILES.

Advertising Manager: THEO. J. CHRISTENSEN.

Communications relative to articles offered for publication should be addressed to Editors of Science, 34 Gramercy Park, New York 3, N. Y.

Communications relative to advertising should be addressed to THEO. CHRISTENSEN, Advertising Manager, Smithsonian Institution Building, Washington 25, D. C.

Communications relative to membership in the Association and to all matters of business of the Association should be addressed to the Permanent Secretary, A.A.A.S., Smithsonian Institution Building, Washington 25, D. C.

Annual subscription, $6.00 Single copies, 15 cents

MISINTERPRETATION AND MISUSE OF THE RECOMMENDED DIETARY ALLOWANCES

By Dr. RUSSELL M. WILDER[1]

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ALMOST four years have elapsed since the Table of Recommended Dietary Allowances (Table 1) was developed by the Food and Nutrition Board of the National Research Council.[2] In this period the table has served, as was intended, as a guide for good dietary planning in civilian life and in the armed services. Also, however, the table has been misused. Criticism of the so-called liberality of the recommendations is partly referable to such misuse.

In developing its recommendations the board was guided by evidence of three types. There were data respecting requirements obtained from experimentation with human subjects who subsisted on diets of predetermined composition. There was a considerable accumulation of information obtained in experiments with animals. There was much experience to indicate that all biologic standards exhibit a range of variation within zones of apparent normality, suggesting that recommendations of allowances of any nutrient, to be applicable to an entire population, would need to provide not for an average individual but for those normal persons whose requirements can be expected to exceed the average.

Misuse of the Table of Recommended Dietary Allowances has been based in part on the false assumption that failure of a diet—any diet—to provide the nutrients in the table in the quantities recommended

[1] Past chairman, at present vice-chairman, Food and Nutrition Board, National Research Council.

[2] Food and Nutrition Board, National Research Council. "Recommended Dietary Allowances." Reprint and Circular Series, National Research Council 115, January, 1943, pp. 6.

was *ipso facto* evidence of dietary inadequacy, or still worse, of nutritional abnormality. Thus, for example, if a dietary survey showed that a certain percentage of a population failed to receive the full allowance of ascorbic acid, the conclusion has been drawn unjustifiably that that same percentage of the population was receiving less than was required of this vitamin. The conclusion is unwarranted for the simple reason that the recommended allowances include a factor of safety of at least 30 per cent. to provide for persons whose requirements may be greater than the average and that persons with average or less than average requirements may obtain all the ascorbic acid that they require with something less than the allowance recommended. Advertisers of vitamin products are almost universally guilty of this type of misuse of the table. They say: "The recommendation is for such and such a quantity. Unless your diet provides such an amount you, Mr. X, will suffer the consequences thereof. You probably are not getting this amount, because surveys show that the diets of some large fraction of the population are defective in this respect. Therefore, Mr. X, you need our vitamins." Setting the recommendations as high as they were set may have encouraged exploitation of the public by such advertising. However, this objection is not good scientific ground for setting lower levels. Surely means can be found for stopping this admittedly undesirable exploitation without distorting the scientific basis respecting food requirements.

However, some critics of the Table of Recommended Dietary Allowances hold that certain goals are set so high as to make them unattainable with relatively liberal supplies of food. There may be truth in this assertion as applied to goals for thiamine and riboflavin in the higher calorie brackets; otherwise the goals can readily be reached with low-cost dietaries, provided foods are used which contain the nutrients that they ought to have—thiamine, riboflavin and niacin, for instance, in the case of flour—and that measures are undertaken to avoid excessive use of vitamin-poor foods, especially sugar, and to minimize loss and waste of nutrient content in cooking and other preparation to which foods are subjected.

Another group of critics consists of economists and administrators who make use of the figures in the table as reference points for policies of food production. They find embarrassment when recommendations for certain nutrients are higher than can be provided by the total food supply of given populations. The complaint is usually restricted to the level set for protein or for certain vitamins and thus resolves itself into recognition that the quality of the food produced is less than what is thought to be desirable to promote good national health. In certain instances, however, notably in the Orient, quantity as

TABLE 1

RECOMMENDED DIETARY ALLOWANCES.* FOOD AND NUTRITION BOARD, NATIONAL RESEARCH COUNCIL

	Calories	Protein grams	Calcium grams	Iron mg	Vitamin A*** I.U.	Thiamin (B_1) mg**	Riboflavin mg	Niacin (Nicotinic acid) mg	Ascorbic acid mg**	Vitamin D I.U.
Man (70 Kg)										
Sedentary	2,500					1.5	2.2	15		
Moderately active	3,000	70	0.8	12	5,000	1.8	2.7	18	75	†††
Very active	4,500					2.3	3.3	23		
Woman (56 Kg)										
Sedentary	2,100					1.2	1.8	12		
Moderately active	2,500	60	0.8	12	5,000	1.5	2.2	15	70	†††
Very active	3,000					1.8	2.7	18		
Pregnancy (latter half)	2,500	85	1.5	15	6,000	1.8	2.5	18	100	400 to 800
Lactation	3,000	100	2.0	15	8,000	2.3	3.0	23	150	400 to 800
Children up to 12 years:										
Under 1 year†	100/Kg	3 to 4/Kg	1.0	6	1,500	0.4	0.6	4	30	400 to 800
1–3 years††	1,200	40	1.0	7	2,000	0.6	0.9	6	35	†††
4–6 years	1,600	50	1.0	8	2,500	0.8	1.2	8	50	
7–9 years	2,000	60	1.0	10	3,500	1.0	1.5	10	60	
10–12 years	2,500	70	1.2	12	4,500	1.2	1.8	12	75	
Children over 12 years:										
Girls, 13–15 years	2,800	80	1.3	15	5,000	1.4	2.0	14	80	†††
16–20 years	2,400	75	1.0	15	5,000	1.2	1.8	12	80	
Boys, 13–15 years	3,200	85	1.4	15	5,000	1.6	2.4	16	90	†††
16–20 years	3,800	100	1.4	15	6,000	2.0	3.0	20	100	

* Tentative goal toward which to aim in planning practical dietaries; can be met by a good diet of natural foods. Such a diet will also provide other minerals and vitamins, the requirements for which are less well known.

** 1 mg thiamin equals 333 I.U.; 1 mg ascorbic acid equals 20 I.U.

*** Requirements may be less if provided as vitamin A; greater if provided chiefly as the pro-vitamin carotene.

† Needs of infants increase from month to month. The amounts given are for approximately 6–8 months. The amounts of protein and calcium needed are less if derived from human milk.

†† Allowances are based on needs for the middle year in each group (as 2, 5, 8, etc.) and for moderate activity.

††† Vitamin D is undoubtedly necessary for older children and adults. When not available from sunshine, it should be provided probably up to the minimum amounts recommended for infants.

well as quality may be inadequate. The United Nations Conference on Food and Agriculture,[3] which met in Hot Springs, Virginia, from May 18 to June 3, 1943, faced this problem quite correctly in their recommendation IX, which reads as follows:

> That the governments and authorities here represented adopt as the ultimate goal of their food and nutrition policy dietary standards or allowances based upon scientific assessment of the amount and quality of food, in terms of nutrients which promote health, and *distinguish clearly between these standards and the more immediate consumption goals which necessarily must be based upon the practical possibilities of improving the food supply of our populations.*[4]

When used as goals for food and nutrition policy or as consumption goals, the recommended allowances ought to be weighted by statistical breakdowns of the population, with classification by age, sex and degree of activity and statistics of the numbers of expectant and nursing women. This has not been done in certain instances; instead the allowances recommended for a moderately active adult man have been the figures to which reference has been made. The difference in the two sets of figures is considerable, as is shown in Table 2. Compared here are the original recommendations for a moderately active adult man and the weighted recommended allowances per capita daily calculated by application of population statistics to the original recommendations for age, sex and other factors supplied by the table of the Food and Nutrition Board. The weighted recommendations in this instance are those developed by the Joint Committee of the Combined Food Board.[5]

The study of the Joint Committee of the Combined Food Board showed that the nutrients at retail outlets available for civilian consumption per day for the United States, Canada and the United Kingdom for the period 1934–38 (or 1935–39) and for each subsequent year up to and including 1943, would with few exceptions meet the weighted recommendations. In the United States, the only exception related to riboflavin, which remained below 2.1 mg until the year 1943. In Canada, riboflavin remained below 2.1 until 1943 and ascorbic acid has been low (61.2 mg in 1943 instead of 71.3). In the United Kingdom, the supply of riboflavin barely met the weighted standard by 1943, and thiamine was low up to the time when mandatory use of the national wheat meal loaf was introduced. In the period 1934–1938, the thiamine supply was 1.2 mg per capita instead of 1.47 mg.

Some economists have expressed the wish to base allowances on minimal average requirements. Such allowances would mean that half the people concerned would require more and half the people less than the figure given but, assuming perfect distribution based on need, a food supply which met the average need would provide for all. It is not to be supposed, however, that perfect distribution can ever be obtained, and furthermore the individual himself has no way of knowing whether his needs are below average or above. Therefore, the only planning that can be countenanced is one that provides enough for all well persons, whether their requirements as related to the average are high or low.

Objections to the recommendations on the part of scientists have been fewer than was anticipated. Subsequent research has, on the whole, supported the conclusions reached in 1941. Attack, where it has come, has been on the allowances for riboflavin, thiamine and ascorbic acid. The values set for these three vitamins allowed a factor of safety. However, a similar factor of safety was applied to the recommendations for calories, protein, iron, calcium and vitamin A, and it is difficult to understand that exception to this liberality should be taken only in the case of thiamine, riboflavin and ascorbic acid. It long has been established that very many adult persons can subsist in quite good health on less than half the amount of protein recommended. There also is much evidence that calories can be lowered to 2,200 or less with a minimum of inconvenience for many normal adult males; yet no scientist has suggested that this would be desirable.

The objections to the allowances for thiamine and ascorbic acid also fail to recognize that these two nutrients, being highly labile substances, are much

TABLE 2

DIETARY ALLOWANCES FOR A MODERATELY ACTIVE MAN AND FOR AN AVERAGE PERSON

	Calories	Prot., gm	Ca., gm	Iron, mg	Vit. A., I.U.	Thiamin, mg	Riboflavin, mg	Niacin, mg	Ascorbic acid, mg
Men moderately active	3,000	70.0	0.8	12.0	5,000	1.8	2.7	18.0	75.0
Weighted by Joint Committee:									
United States (1943)	2,531	65.2	0.94	11.7	4,560	1.45	2.1	14.5	70.7
Canada (1943)	2,544	66.1	0.96	11.8	4,590	1.45	2.1	14.5	71.3
United Kingdom (1943)	2,546	64.6	0.91	11.7	4,664	1.47	2.2	14.7	71.0

[3] United Nations Conference on Food and Agriculture, Hot Springs, Virginia, May 18 to June 3, 1943. Final Act and Section Reports. Washington: U. S. Government Printing Office, 1943.

[4] Italics ours.

[5] Joint Committee, Combined Food Board, U. S. Dept. of Agriculture, War Food Administration. Washington: U. S. Government Printing Office, April, 1944.

more easily lost to the consumer than any other of the nutrients mentioned in the Table of Recommended Dietary Allowances. The factor of safety applied to thiamine was less than that applied to several other nutrients. It was not supposed to cover cooking losses; yet it does so serve to some extent for that part of the population with requirements which are less than average. Losses from cooking in the case of thiamine and ascorbic acid are far greater than is the case with the other nutrients named in the table. Also loss after eating but before absorption is a factor to be reckoned with and can be expected to be greater in the case of thiamine and ascorbic acid than with the other nutrients. In other words, the need for a factor of safety for thiamine and ascorbic acid is greater than for any other nutrient in the table.

The objections of some scientific workers to the levels set for thiamine, riboflavin and ascorbic acid are based on recent evidence of minimal requirements. This evidence, although representing carefully conducted investigation, all relates to small groups of experimental subjects studied for periods—at the longest six to nine months—representing no more than 1 per cent. of the life span of the human species. Other studies with other subjects point to higher minimal requirements. Also much investigation with lower animals has shown that allowances which seem to be quite adequate to provide for health and vigor for short periods of the life span are quite inadequate to maintain good health for the life span as a whole. Furthermore, good nutrition must demand that the individual shall possess stores of nutrients as reserves to meet emergencies. There has been dispute about whether evidence of diminishing reserves is acceptable as a criterion of requirements. Be that as it may be, the fact remains that persons who possess reserves are better able to withstand not only temporary deprivations but also stresses such as are involved in surgical operations or disease than persons who lack reserves. This has long been well established for protein and iron, and evidence is now at hand that it applies as well, possibly even more acutely, to reserves of vitamins, and especially to the body's store of thiamine, which is relatively rapidly depleted when the intake falls below requirements.

On the other hand, the recent evidence suggests that requirements for thiamine and riboflavin are less closely related to the total calories of the diet or to total expenditure of energy than appeared to be the case when allowances for these vitamins were recommended. The present recommendations of 0.6 mg of thiamine and 0.9 mg of riboflavin for each 1,000 calories are readily defensible when the calorie intake is 2,500 or less. They are less defensible for higher calorie brackets. The great majority of diets for adult men and women provide not less than 2,000 nor more than 3,000 calories. Therefore, it is justifiable to consider setting a single allowance for thiamine (1.5 mg) and one for riboflavin (2.0 mg) for all normal adult men and women, with an accompanying suggestion that, when either the calorie value of the diet or the expenditure of energy is much more than 2,500 or 3,000 calories, additional thiamine and riboflavin may be necessary. A similar simplification may be desirable in the case of niacin.

Revision of the Table of Recommended Dietary Allowances is under consideration at the present time. As was the case before, the recommendations, when they are made, will represent so far as possible the consensus of informed opinion as to the amounts justified by available evidence respecting the range of requirements of normal persons.

PLANT BREEDING IN RELATION TO HUMAN NUTRITION[1]

By Dr. R. J. GARBER

DIRECTOR, U. S. REGIONAL PASTURE RESEARCH LABORATORY, U. S. DEPARTMENT OF AGRICULTURE

A PROMINENT economist[2] has stated recently that after ten years in which to reorganize its agriculture and to readjust its consumption, this nation could feed twice its present population at a higher level of health and of working efficiency than under present conditions. Here is a challenging statement to all agriculturists, regardless of whether they consider the establishment of such a goal as feasible or, perhaps, in one of its implications, even desirable. There can be no serious dissent from the idea of maintaining a level of human nutrition that assures health and working efficiency, but for the continued development of a higher order of civilization it is not unlikely that population should level off at a place well below the complete utilization for food of all that could be produced efficiently.

All available evidence indicates that man lived for a few million years as a savage when practically all his energies, aside from those required from time to time in fighting enemies, were expended in acquiring food and shelter. These he took more or less as nature had provided them or as he could prepare them by primitive means ready at hand. From this plane of

[1] Address of the vice-president and chairman of the Section on Agriculture (O) of the American Association for the Advancement of Science, Cleveland, Ohio, September, 1944.

[2] Jno. D. Black, "Food Enough." The Jaques Cattell Press. 1943.

existence there emerged and developed an agricultural type of civilization. During several thousand years man learned to grow crops and domesticate animals to satisfy his wants but, owing to lack of agricultural knowledge, dependence on hand tools or crude implements, the surplus production was never very great. Partly because of this and partly because of poor transportation facilities large segments of mankind were periodically subjected to famines with all their disastrous consequences. It is only in the last two hundred years that man has acquired the agricultural knowledge and developed the machinery necessary to grow and process the vast surpluses which we in the United States are at present capable of producing.

We associate this modern era with the most remarkable and rapid progress known to man. We take for granted and accept the modern fruits of agriculture and industry, not always realizing that they could not have been developed except for an earlier and contemporaneous development of the physical and biological sciences. Of even greater importance to this and succeeding generations is the fact that continued and further progress is only possible with further scientific knowledge.

When man reached that stage in his agricultural development where not all his energy was required to produce the necessities of life, he began to have more time for thinking and theorizing and later for experimenting to determine the truthfulness of his theorizing. It was in such an environment that the sciences were developed. We should see to it that man never again is compelled to revert to the state of expending all or even the greater part of his energies in merely providing the essential necessities of life. For fear of being misunderstood let me emphasize that this is not necessarily a plea for more leisure, indispensable as that is for health and happiness. It is a plea for work of a kind that assures continued progress in man's struggle for a higher plane of living.

It is hardly necessary to mention to a generation that has experienced two disastrous world wars that social progress has not been all that could be desired. We are not particularly concerned with this problem here except to point out that social progress must go hand in hand with progress in other lines of human endeavor. In fact, if this does not happen we will probably continue trying to settle our differences by wars, each more terrible than its predecessor. I am inclined to agree with E. Parmalee Prentice[3] in his contention that the acquisition of adequate food has been one of mankind's strongest motivating influences in determining his social evolution. Periods of population pressure and consequent sharpened wants without ready means of gratification are associated with discontent, upheavals and tyranny. Two remedies suggest themselves: Reduction of population pressure and production of more food at relatively low cost. The former is not under consideration at the moment except to note that, unless a solution is eventually found to this phase of the problem, we are likely to find ourselves in a "vicious circle," for certainly there is a limit to the quantity and quality of food that may be produced.

What is the plant breeder's possible role in this world drama? He can help meet the food challenge by breeding more productive and more nutritious plants for direct or indirect consumption by man. I shall discuss the question by citing some objectives that already have been attained by breeding and by pointing out some possibilities for the future.

SOME ACCOMPLISHMENTS OF THE PLANT BREEDER

The plant breeder, in common with most other agricultural scientists, has devoted his major efforts toward increasing production at lower cost. While he has not neglected quality particularly in its more general aspects, the breeding of plants to enhance specific nutritive values for man is a relatively new venture and one that has not as yet received a great deal of attention.

Dr. M. A. McCall,[4] of the United States Department of Agriculture, has summarized recently some of the increased yields that have resulted from plant breeding. It is estimated that the increased yield from hybrid corn grown in the United States in 1943 was 669,480,000 bushels or the equivalent to 7,364,280,000 pounds of pork, enough to supply each man, woman and child in the nation with 54 pounds. The new varieties of oats resistant to smut and rust, Vicland, Cedar, Tama, Vikota, Control and Marion, will probably increase average yields at least 7.5 bushels per acre. Based on the estimated acreage occupied during the present year these varieties will result in an increased production of 75,000,000 bushels of valuable feed, or, if consumed directly by man as oatmeal, the equivalent of seven servings for each of the something over two billion persons in the world. Thatcher, a hard red spring wheat released in 1934, rapidly replaced the then existent varieties because of its resistance to stem rust. Unfortunately, Thatcher in common with other commercial varieties grown at that time was susceptible to leaf rust and as a consequence was damaged to some extent during years when this disease was present. In the meantime other new varieties, such as Regent, Rival and Pilot, that were resis-

[3] E. Parmalee Prentice, "Food, War and the Future." Harper and Bros. 1944.

[4] M. A. McCall, "Crop Improvement, a Weapon of War and an Instrument of Peace," an address presented at the annual meeting of the American Society of Agronomy. 1943.

tant to leaf rust as well as stem rust, had been bred. It is estimated that in 1942 when stem rust was present the growing of resistant varieties resulted in the production of 100,000,000 additional bushels of hard red spring wheat in the states of Minnesota, North Dakota and South Dakota. I am advised by Dr. H. K. Hayes, of the Minnesota Agricultural Experiment Station, that promising varieties released for distribution in 1944 include Newthatch from Minnesota and Midas from North Dakota.

The growing of disease resistant varieties not only increases average production but provides crop insurance. For example, in 1935 when stem rust was prevalent, Thatcher wheat on 31 farms located in 16 counties of Minnesota[5] yielded on the average 27.3 bushels per acre compared with 6.5 bushels for Marquis grown in the same fields. To the individual farmer the growing of resistant or susceptible varieties in epidemic years may mean the difference between success and economic disaster. Many other equally impressive examples of increased production of food or feed brought about by the efforts of plant breeders might be mentioned not only among field crops but vegetable and fruit crops as well. Likewise, a lengthy discussion would be required to present the marked advances that have been made in breeding plants for fiber, oil and other uses, but let us turn now to a brief consideration of accomplishments more in line with enhancement of nutritional values of direct use to man.

About fifteen years ago a close physiological association between yellow endosperm and provitamin A was found by the Indiana Agricultural Experiment Station[6] among the segregates from a cross between Reid Yellow Dent and Johnson County White corn. Shortly thereafter the Texas Station[7] demonstrated a quantitative relation between the inheritance of yellow endosperm and provitamin A in dent corn. Since endosperm is triploid, monohybrid inheritance for the dominant yellow color would lead to the following factorial compositions: YYY, YYy, Yyy and yyy. The triple recessive would, of course, be white. It was shown that the endosperms with these genotypes carried on the average 7.5, 5.0, 2.25 and 0.05 units of provitamin A per gram, respectively. It is probable that similar relations exist among yellow and white sweet corns.

The Louisiana Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture has shown that sweet potatoes may be bred for a higher carotene content. Among the F_1 seedlings from crosses between heterozygous parents, selections were made that far exceeded either of the parents in micrograms of carotene per gram of sample. This investigation, together with others that have been reported, indicate that varieties of sweet potatoes may be developed with distinctly higher nutritive values than those now in commercial production.

The U. S. Southeastern Regional Vegetable Breeding Laboratory is actively engaged in breeding certain vegetables for higher ascorbic acid (Vitamin C) content. Dr. B. L. Wade, in charge of the laboratory, has recently informed me that there have been released for general distribution two varieties of cabbage with distinctly higher ascorbic acid content than any commercial varieties now grown in the area. In cooperation with the Florida Agricultural Experiment Station, a variety of snap beans has been developed which possesses, in addition to hardiness and disease resistance, an ascorbic acid content as high if not higher than competing commercial varieties.

Poole, Grimball and Kanapaux[8] have obtained results which show that hereditary factors are more important than season or location in producing ascorbic acid differences among 25 lines of cabbage. Season to season differences were significant in six lines, but in only one was the ascorbic acid content greater in the fall than in the spring. A negative correlation was reported between ascorbic acid concentration and head weight. Wade, Heinze, Kanapaux and Gaetjens[9] have found in certain snap bean crosses transgressive segregation for ascorbic acid content, indicating that two or more complementary hereditary factors are operating to determine ascorbic acid content in this vegetable and that the chances are good for synthesizing a new variety distinctly superior with respect to this substance.

These few examples will serve to show that the plant breeder has already made a beginning in increasing the vitamin content of plant parts used directly for human food. It is, however, just a beginning in a field of activity that should be productive of gratifying results.

Substantial progress has been made in selecting and breeding plants for quality, flavor, sugar content and other characteristics that make the plants more desirable as human food when it was known what was desired by the consuming public. This statement is particularly true if one considers the prodigious effort of both the known and unknown plant breeders that has gone into creating the many highly acceptable vegetables, fruits and nuts we possess to-day. Selec-

[5] H. K. Hayes, E. R. Ausemus, E. C. Stakman, C. H. Bailey, H. K. Wilson, R. H. Bamberg, M. C. Markley, R. F. Crim, M. N. Levine, *Minn. Agr. Expt. Sta. Bul.* 325, 1936.

[6] S. M. Hauge and J. F. Trost, *Jour. Biol. Chem.*, 86: 167–172, 1930.

[7] P. C. Mangelsdorf and G. S. Fraps, SCIENCE, 73: 241–242, 1931.

[8] Chas. F. Poole, Paul C. Grimball and Margaret S. Kanapaux, *Jour. of Agr. Res.*, 68: 325–329, 1944.

[9] B. L. Wade, P. H. Heinze, M. S. Kanapaux and C. F. Gaetjens, "Inheritance of Ascorbic Acid Content of Snap Beans." In press. *Jour. Agr. Res.*

tions made by early man, even though they may have been made more or less unconsciously, were undoubtedly an important determinative factor, but rapid progress was not made until the importance of inheritance was appreciated. A mere listing of accomplishments in this general field would fill pages. There are practically no vegetable, fruit or nut crops in common use to-day that have not been improved in quality, flavor or some other important characteristic by plant breeding. It may be profitable now to consider some possible future activities.

POSSIBLE FUTURE OBJECTIVES OF THE PLANT BREEDER

The plant breeder who is attempting to improve the nutritive value of plants for man is oriented in his efforts by developments in the field of nutrition. We know enough about plants to assert with confidence that every plant character, whether it be morphological or physiological, is conditioned in its expression by two sets of forces, environmental and hereditary. Effective progress of the breeder will depend upon the range of hereditary variation in the plant material. As the nutritionist learns more and more about the plant substances essential to the nutrition of man, the breeder may correspondingly focus his attention on the more important substances and particularly those that show a wide range of hereditary variation.

As has been pointed out already, some progress has been made in breeding plants for increased vitamin content, but this field of endeavor has barely been opened and prospects for the future appear promising indeed. Newman[10] reported consistent differences in thiamin (B_1) content between varieties of spring wheat grown at different locations in the prairie provinces of western Canada. Similar differences have been found between varieties of winter wheat grown in the Great Plains of the United States. These facts suggest that it would be entirely feasible to produce by breeding a wheat with a higher B_1 content than any now commonly grown. Moreover, it may even be possible to change by breeding the relative thiamin content of different parts of the wheat kernel separated in milling. If this could be done it might prove of importance, as present milling processes and the preference of the consuming public for white bread make it difficult to recover the desired amount of B_1 in the flour. Making up this deficiency by "enriching" the flour is now quite generally practiced, but I understand there are some experts in human nutrition who believe that until we know more about the specific functions of the vitamins and their interrelations, it is preferable to "enrich" by natural rather than by artificial means. Be that as it may, when one considers the importance of wheat flour in the human diet, it behooves plant scientists, millers and nutritionists all working together to make this product as wholesome as is possible.

Adams and Smith[11] have recently summarized results that have been obtained at various agricultural experiment stations in studying varietal differences of fruits and vegetables with respect to vitamin content. The Maine Station has shown that onions varied widely with respect to ascorbic acid content, depending on variety. Similarly, workers of the North Carolina Station and the U. S. Department of Agriculture have demonstrated differences with respect to this substance among varieties of blueberries, blackberries, dewberries, raspberries and muscadine grapes. Varieties of peaches may be a poor or good source of carotene (provitamin A), according to the Arkansas Station. Seventeen varieties ranged from 20 to 500 micrograms of carotene per 100 grams of peach or the equivalent of 33 to 833 International Units. Both the carotene and ascorbic acid contents of avocados vary widely, as shown by studies in Florida. These few examples of varietal differences are undoubtedly typical of many that may be found among other fruits and vegetables. While it is true that environment, stage of growth, storage, processing and other factors are all important in determining the vitamin content of plant parts at the time they are consumed by man, the existence of significant hereditary differences with respect to these essential substances is all the assurance the trained plant breeder needs in order to proceed with confidence in his ability to produce new forms superior with respect to vitamin content. *However, this is probably not sufficient justification to launch an extensive breeding program.* The breeder should have the assurance of the nutritionist that an important nutritional need will be met if the proposed breeding program is successful. I think it is fairly obvious that the nutritionist and the plant breeder must work together if the latter's efforts are to be most effective in raising nutritional levels for man.

In considering possibilities for enhancing vitamin content of plants by breeding, the lower forms such as algae and yeast should not be overlooked. In a recent report by Spoehr[12] it is pointed out that because of the rapidity of growth of certain algae supplied with air, light and simple mineral nutrients, they may become an important source of vitamins. Species of algae were found to vary greatly with respect to carotene content. Yeast may become a more important source of B vitamins as well as pro-

[10] T. H. Newman, *Jour. Am. Soc. Agron.*, 109–116, 1942.

[11] Georgian Adams and Sybil L. Smith, *U.S.D.A. Misc. Pub.* 536. 1944.

[12] H. H. Spoehr, "Annual Report of the Chairman of the Division of Plant Biology." (Reprinted from Carnegie Institution of Washington Year Book 42. 1943.)

tein for human food. Burkholder[13] has estimated that the breweries of America could supply annually about 200 million pounds of yeast, half of the dry matter being nutritious protein. This estimate is based on an output of 65 million barrels of beer and on the assumption that the brewers fully utilized their yeast by-products. In connection with a study of some 200 kinds of yeasts with respect to their production of vitamin B_2 Burkholder reported a strain isolated from sour milk that was particularly efficient in the production of riboflavin. Here is a fascinating field for the breeder of the lower plant forms.

Taking up next the mineral constituents in human food we find that in recent years significant advances in our knowledge have been made. Early nutritionists placed major emphasis on proteins, carbohydrates and fats with some attention to water and minerals. Later vitamins came into prominence. As a result of numerous studies in recent years, minerals are now recognized as essential factors in most if not all metabolic processes taking place in the body. The ash of the body is composed primarily of calcium, magnesium, sodium, potassium, phosphorus, sulfur and chlorine. The trace elements known to be essential to animal life are iron, copper, iodine, manganese, cobalt and zinc. With the exception of sodium, chlorine, iodine and cobalt, plants require these same elements and in addition boron. The significance of other trace elements found in the ash of plants is not understood at present. It is known that certain elements, such as selenium, arsenic, lead and fluorine, may be definitely poisonous in relatively low concentrations to both plants and animals. Since practically all man's food except fish and common salt must come directly or indirectly from land plants, the importance of the soil-plant relation becomes obvious. One of the Federal Bankhead-Jones Regional Laboratories is concentrating on a study of the three-way relation between soil, plant and nutrition.

It is well known that the mineral and other constituents of plants reflect within biological limits the mineral and other constituents of the soil on which they grow. The mineral deficiency diseases of animals in certain areas are good examples of how serious may be the consequences of a deficiency in the soil. It is also well known that different species of plants growing under similar conditions may vary widely with respect to their mineral contents, although less is known regarding variation between strains and varieties. Dr. R. R. Robinson, working at the U. S. Regional Pasture Research Laboratory, found significant and consistent differences with respect to calcium and phosphorus in clones of white clover when grown on different soils. It is reasonable to expect that hereditary differences exist among plants in mineral assimilation just as in other respects.

The plant breeder undoubtedly could produce strains of plants that would be relatively efficient in extracting certain elements from the soil, and such strains might be useful at least temporarily in controlling some deficiency diseases. It should be recognized, however, that regardless of the success of plant breeding efforts in this direction, eventually, depleted or missing elements in the soil must be supplied by artificial means. On the other hand, the plant breeder is probably on more stable ground to breed for the enhancement of those plant constituents which for their development draw largely on elements that are normally present in abundance such as nitrogen, carbon, oxygen and hydrogen. In this category of plant constituents occur proteins, carbohydrates and fats. Much has already been accomplished along this line, but there is still much to do. As soon as more is learned regarding the function and relative importance of the various fractions of these three food essentials in the diet of man, the breeder will be in a position to select plants for the desired characteristic.

Another approach to improving dietary values both with respect to quantity and quality is by breeding for better animals or better animal products to be consumed by man. Marked progress has already been made, as is evident from the better types of meat, dairy and egg producing animals that have been bred, but much still remains to be done. To point out but one line of work that promises a bright future, breeding for disease resistance may be mentioned. The control or elimination of bovine mastitis would increase greatly milk production or the subjugation of avian leukosis would add enormously to egg production. Breeding may never completely control such diseases, but certainly such an attack would be helpful in solving the problem. Some recent results from swine breeding would appear to justify a further application in animal breeding of methods so successfully used by plant breeders, namely, inbreeding as a means of selection followed by the incorporation of hybrid vigor in the commercial variety. It is not within the scope of this paper to discuss animal breeding, but I think it is fairly obvious, as in the case of plant breeding, that work in this field may be expected to continue to make substantial contributions to raising the nutritional level of mankind.

Just as plants, within certain biological limits, reflect the nature of soils on which they grow so, likewise, animal products reflect to some extent the composition of plants on which the animals feed. This suggests still another approach for the plant breeder, namely, to improve crops from the standpoint of

[13] Paul R. Burkholder, *The Yale Scientific Magazine*, 18: No. 1, October, 1943.

animal nutrition. Forage crop breeding, although recently developed, seems to offer unusual opportunities. Not only is it important to obtain greater yields and yields more uniformly distributed throughout the growing season, but it is likewise important to obtain forage of such a composition as to be highly nutritious to grazing animals and therefore of indirect benefit to man. The most economic feed for cattle, sheep and other farm animals is pasture. To provide adequate nutritious herbage throughout the grazing season is the aim of the breeder working with pasture plants. Breeding for some qualitative characteristics in forage crops will have to await the further development of information regarding the nutritional requirements of man and of the animals that help to sustain him.

CONCLUSION

To conclude, the plant breeder has a very definite responsibility in helping to place man on a higher nutritional plane and hence to help make him a more effective and contented member of society. I like to think of the problem from this angle rather than from the standpoint of producing more food just to feed more people. Plant breeders collectively have played an important role in bringing about the high agricultural production of which we are capable at present. Only a beginning has been made in improving the nutritional qualities of food by plant breeding, but results already obtained indicate a promising future for this field of activity. The nutritional values of various plant constituents are guideposts for the plant breeder and in many instances information is incomplete. He can probably accomplish most by seeking to enhance those plant constituents of a high nutritive value that are largely dependent for their development on elements abundantly present in the plant's environment. A natural corollary is to breed plants for a reduction of constituents that inhibit nutritional value. In the long run the problem of mineral deficiencies in the soil can probably best be solved either by adding the deficient element to the soil or directly to the diet. The breeder already possesses the techniques and methodologies to enhance heritable nutritional factors in plants once those factors have been clearly identified. However, in order to proceed with confidence in the value of the final outcome of his endeavors in this direction he should have the constant guidance and counsel of the nutritionist. They working together must answer the significant question, What will be the real value of enhancing this or that component of the aggregate that constitutes the human diet?

OBITUARY

SAMUEL J. RECORD
1881–1945

FIFTY years ago when Samuel Record was sawing and splitting wood for the family stove he would have objected emphatically had he suspected that he would spend half his life working with that very substance which to a boy was so loathsome. It must be admitted that the tropical woods to whose study he later gave attention were more glamorous if not more practical than the oak and hickory of Indiana.

The abundant and detailed knowledge incorporated in his last and most important publication, "Timbers of the New World," was not acquired easily or quickly but as the result of long and tedious inquiry into the nature and composition of American forests, their various kinds of woods and the practical purposes to which they can be put.

Born at Crawfordsville, Indiana, on March 10, 1881, he attended Wabash College, the alma mater of a substantial number of men eminent in botanical science. He graduated in 1903 and received the M.A. degree in 1906 and an honorary doctorate in sciences in 1930. His interest turned to forestry after his graduation, and he received the degree of Master of Forestry from Yale University in 1905. He gained practical knowledge of forestry problems during several years spent with the U. S. Forest Service. He was the first supervisor of the Arkansas and Ozark national forests, which lie in a region celebrated for the great variety of its trees. He joined the faculty of the Yale School of Forestry in 1910 and was appointed professor of forest products at Yale in 1917. Thereafter he was associated with the university until his death on February 3, 1945, having been in charge of tropical forestry since 1923, and Pinchot professor of forestry and dean of the School of Forestry since 1939.

Professor Record's keen practical interest in woods caused him to visit Guatemala, Honduras, British Honduras and many parts of the United States, to make collections himself and to interest and instruct others in the collection and proper preparation of specimens. He soon learned that many of the older collections of tropical woods in museums were useless since they obviously were not from the trees which they were said to represent. He elevated wood collecting from its former status of guesswork and curio gathering to a truly scientific occupation, insisting that the samples of wood should be accompanied by determinable herbarium specimens and thus be associable with described species of plants. Through an unbelievably large number of correspondents scat-

tered over almost all parts of the globe he was able to bring together a collection of wood samples, all identified with known species, numbering more than 41,000 specimens. Many of the individual lots of woods, some of them small but important, were secured with the help of amateurs to whom he communicated something of his enthusiasm. The Yale collection includes material of most genera of woody plants of the Americas and of many from the Old World.

With this wood collection Professor Record was on intimate terms, and his knowledge of woods seemed uncanny to one unversed in the subject. Although regularly he called upon taxonomists to determine herbarium collections, he often could help them materially in naming strange plants by his own study of even slender twigs of plants that were sterile or otherwise difficult of recognition by ordinary methods. He enjoyed solving some of the minor problems of wood-lore. How did it happen that wood specimens sent from New Mexico were packed in a box made of Chilean Araucaria? Of what woods were made the articles found in Egyptian tombs or the ancient ship timbers retrieved from the sea?

Woods are obviously a subject of immense economic importance, and the utility of data regarding them requires no emphasis. The woods of the United States have long been pretty well known but those of tropical America have not. Some of the most important cabinet and other woods imported into the United States were known only by their vernacular names and the report that they came from some sort of a tree somewhere in the tropics. Professor Record went to great trouble to obtain authentic specimens of all such woods and of the trees that produced them. He was finally able to place properly almost all these long uncertain trees, as may be seen in his "Timbers of the New World," the most comprehensive and encyclopedic account of the woods of any great area of the earth.

Interested in establishing a common medium for dissemination of information among wood anatomists, whose vocabularies often had been personal rather than national or international, Professor Record was one of the founders of the International Society of Wood Anatomists. An important advance in the study of wood anatomy was made by the compilation of a list of equivalent terms for description of woods in the principal European languages.

Another successful enterprise was his publication of the quarterly journal *Tropical Woods,* begun in 1925 and now running to 80 numbers. This reviews current literature relating to tropical woods but consists in greater part of original papers relating to trees and their properties. This journal has had a more catholic distribution perhaps than almost any other American scientific publication. It reaches all the principal botanical libraries of the world and also finds its way to forestry stations in the remotest parts of Africa and the islands of the Pacific, and other places with meager library facilities. *Tropical Woods,* aside from its importance as a place of publication for research, was of aid in the enlargement of the Yale wood collections, since many people sent collections to Professor Record to be named, studied and reported upon if their contents justified comment.

The evident practical value of this wood research was recognized by the lumber trade of the United States, which often consulted him for aid in its difficulties. His long experience gave him a realistic appreciation of commercial phases of the subject, and his opinions were invoked to settle disputes, often acrimonious, that arose in the industry.

Professor Record's success in investigation of the woods of all parts of the earth well illustrates the eminently desirable, but too seldom attained, combination of highly technical knowledge and its practical application to daily life. Boards for construction purposes and microscope slides of wood are both lumber, the latter merely cut thin. While he had to a notable degree the gift of common sense in consideration of practical problems, he appreciated equally that portion of wood research that ordinarily would be termed "pure" science, and he organized, principally on the basis of his own studies, the whole system of wood anatomy so far as it is illustrated by the forests of tropical America.

A chronological list of his chief publications gives a good idea of the growth of his interests: "Identification of the Economic Woods of the United States," 1912; "Mechanical Properties of Wood," 1914; "Timbers of Tropical America" (joint author), 1924; "Identification of the Timbers of Temperate North America," 1934; "Forests and Flora of British Honduras" (joint author), 1936; "Timbers of the New World" (joint author), 1943.

My personal knowledge of Professor Record's work, extending over a good many years, is based upon a close association in the study of tropical American trees. For a long time he has been rather closely associated with Field Museum of Natural History and a member of the staff since 1928. He assisted in assembling and arranging the exhibits of the Museum's Hall of North American Woods. For several years he visited the Museum regularly for this purpose, and he wrote a popular guide to the wood hall which is practically a handbook of North American trees.

It always is difficult to express exactly one's impressions of the personality of a deeply valued friend. In the case of one who lived so full a life, with contacts extending into so many fields of activity, it is

doubly difficult. With a very definite dignity, Professor Record possessed an interest in human life that enabled him to meet on common ground a bootblack or a newspaper magnate, and he possessed an extraordinary talent for making friends. To an unusual degree Professor Record enjoyed life in all its phases, simple or sophisticated, and he had the faculty of making others in his company enjoy themselves almost as much as he evidently did. So greatly was his companionship valued that even casual acquaintances often went to considerable pains to enjoy his company again. A great many of his friends, many of them quite outside the farthest bounds of science, will indeed miss the contacts that have been broken so abruptly. They are only beginning to realize how much they depended upon his generous support and counsel.

PAUL C. STANDLEY
CHICAGO NATURAL HISTORY MUSEUM

SCIENTIFIC EVENTS

REORGANIZATION OF THE GEOLOGICAL DEPARTMENT OF MYSORE

IT is reported in *Current Science,* Bangalore, India, that the Geological Department of Mysore, originally organized in 1894 for conducting a geological and mineral survey of the state, was in later years obliged to curtail many of its activities on account of severe retrenchment to which the department was subjected. Within the last ten or twelve years, however, the department has started on an extensive program of large-scale prospecting, mining, geophysical and soil surveys, including underground water resources. The limited staff at its disposal was found to be absolutely inadequate to cope with this continually growing volume of work, and realizing the need for its urgent increase, the Government of Mysore has recently reorganized this department sanctioning fully the proposals of the director.

Under the scheme now in effect, the routine geological work in the state will be allocated among three divisions to be newly constituted, each division forming a unit comprising three administrative districts in Mysore. Each of these divisions will be in charge of a division geologist, who will be responsible for all routine geological work within his division, subject to the administrative control of the director. He will be assisted by two assistant geologists. Assaying and other laboratory investigations of a purely scientific and fundamental character will be carried out under the immediate supervision of the director.

The technical and administrative staff includes one senior geologist, three geologists, six assistant geologists, one geophysicist, one assistant geophysicist, one inspector of quarries and museum curator, two chemists and one assistant chemist.

THE FOUNDATION FOR INDUSTRIAL RESEARCH OF THE UNIVERSITY OF WICHITA

A FOUNDATION FOR INDUSTRIAL RESEARCH has been established at the University of Wichita, which has been made possible by the gift of $450,000 contributed by local business and industry. Started by voluntary subscriptions of $100,000 each from the Beech Aircraft Corporation and the Cessna Aircraft Company, the fund is expected to reach the half million mark. The program calls for expenditure of the original fund within the next ten years, thus providing a substantial annual sum which will be used in the main to supplement the present research staff and to improve present laboratory facilities.

Dr. W. M. Jardine, president of the municipal university, points out that Wichita is a vital war production area and following the war will face the task of maintaining employment in its readjustment to peacetime economy. Many sub-contractors and scientific men who came to the city to engage in war work wish to remain—some to carry on with industries already established and others to engage in new fields of enterprise. Many problems involving industrial research have arisen in these industries. The primary purpose of the foundation is to maintain facilities and personnel for research and testing work in this connection.

Applied and pure research will be conducted in aeronautics, engineering, agriculture, chemistry, physics, geology, petroleum and marketing analysis and outlets. Fellowships and scholarships will be established whereby outstanding students may engage in graduate study pertinent to the work of the foundation. Research on problems submitted to the foundation will be undertaken for industrial firms at their expense, with all results being turned over to them.

In a statement made by President Jardine he views the Foundation for Industrial Research as a step forward in integrated education—cooperation between business, industry and the university. Management of the foundation is vested in a Board of Governors consisting of nine members appointed by the Board of Regents: six from industry and two from the Board of Regents. The president of the university is automatically a member.

THE SOCIETY OF ECONOMIC GEOLOGISTS

THE annual technical sessions of the Society of Economic Geologists, which were to have been held

in New York City from February 19 to 22, were cancelled in deference to the general request by the Government that meetings calling for extensive travel be cancelled when possible. However, the annual business meeting of the society and the meeting of its council were held on February 20 in New York City. After the dinner at the Harvard Club, attended by forty-five members and guests, announcement was made of the election of the following new officers:

President-elect (1946): W. O. Hotchkiss.

First vice-president-elect (1946): J. Terry Duce.

Councilors (1945–47): George M. Fowler, F. M. Cameron, T. G. Moore.

Regional vice-presidents (1945): Alfred Brammall (Europe); J. M. S. Krishnan (Asia); R. A. Pelletier (Africa); George Hanson (North America); O. H. Leonardos (South America); R. Lockhart Jack (Australia).

Fifteen new members were declared elected. A brief business session was followed by an address, entitled "Economic Geology," by the retiring president, John M. Boutwell.

THE AGRICULTURAL BOARD OF THE NATIONAL RESEARCH COUNCIL

ACTING upon the request of the Association of Land Grant Colleges and Universities, the National Research Council has set up an Agricultural Board, consisting of the following:

Chairman: W. C. Coffey, president, University of Minnesota.

Vice-chairman: C. H. Bailey, dean, Department of Agriculture, University of Minnesota.

Secretary: R. E. Buchanan, director, Agricultural Experiment Station, Ames, Iowa.

E. C. Auchter, director, Pineapple Research Institute of Hawaii.

Thomas Cooper, dean, College of Agriculture, University of Kentucky.

J. S. Davis, director, Food Research Institute, Stanford University.

M. J. Funchess, dean, School of Agriculture, Alabama Polytechnic Institute.

C. B. Hutchison, dean, College of Agriculture, University of California.

W. H. Martin, director, New Jersey Agricultural Experiment Station.

L. A. Maynard, director, School of Nutrition, Cornell University.

W. I. Myers, dean, New York State College of Agriculture, Cornell.

H. P. Rusk, dean, College of Agriculture, University of Illinois.

Ex-officio: Frank B. Jewett, president, National Academy of Sciences; Ross G. Harrison, chairman, National Research Council; Robert F. Griggs, chairman, Division of Biology and Agriculture, National Research Council.

AWARDS OF THE WASHINGTON ACADEMY OF SCIENCES

THE three hundred and thirty-second meeting of the Washington Academy of Sciences was devoted to the presentation of awards for scientific achievement for the year 1944, as follows:

Biological sciences, to Dr. Norman H. Topping, National Institute of Health, in recognition of his distinguished service in identifying eastern and western types of Rocky Mountain spotted fever.

Engineering sciences, to Galen B. Schubauer, National Bureau of Standards, in recognition of his distinguished service in aeronautical engineering, particularly for fundamental measurements of turbulence.

Physical sciences, to Professor George A. Gamow, George Washington University, in recognition of his distinguished service in theoretical physics, particularly in the understanding of atomic nuclei and of stars.

The recipients gave a brief summary of the work for which the awards were made.

SCIENTIFIC NOTES AND NEWS

DR. ARTHUR H. COMPTON, dean of the division of physical science and chairman of the department of physics of the University of Chicago, has received the Washington Award for devoted, unselfish and pre-eminent service in advancing human progress, in recognition of "his research and teaching in the physical sciences, increasing man's knowledge of the action of x-rays and cosmic rays." Members of the commission of award represent the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Western Society of Engineers.

THE Elliott Cresson Gold Medals of the Franklin Institute of Philadelphia have been awarded for 1945 to Rear Admiral Stanford Caldwell Hooper, U.S.N., retired, for his work in radio for the U. S. Navy, and to Professor Lewis F. Moody, of Princeton University, for his work on the design and development of hydraulic turbines and pumps.

THE Legion of Merit has been conferred on Colonel Anthony J. Lanza, Medical Corps, U. S. Army, chief of the Occupational Hygiene Branch of the Office of the Surgeon General, for his share in the development of the health program of the Army for civilian workers in Army-owned and operated industrial plants.

DR. CHARLES J. BARTLETT, professor of pathology, emeritus, of the School of Medicine of Yale University and for many years president of the Connecticut Medical Examining Board, recently was the guest of honor at a dinner given by the New Haven Medical Association on December 18 celebrating his eightieth birthday.

Chemical and Engineering News reports that John C. Olsen, professor emeritus and formerly head of the department of chemical engineering of the Polytechnic Institute of Brooklyn, will be honored by his former students and friends at a dinner to be given on April 7 at the Hotel Bossert, Brooklyn. At the dinner a portrait of Dr. Olsen, recently completed by Wilford Seymour Conrow, will be unveiled. It will be presented to the Polytechnic Institute on behalf of the donors, who include former students of Dr. Olsen, faculty members and other associates of the institute, fellow members of the chemical engineering profession and a number of personal friends.

FIVE Frank B. Jewett fellowships for research in the physical sciences have been awarded to Dr. Elliot R. Alexander, Dr. Albert S. Eisenstein, Dr. Kenneth Greisen, Dr. Boris Leaf and Dr. Harry Pollard. Their availability to accept the fellowships will depend upon the progress of the war, as each is now engaged in essential war research. The fellowships, founded by the American Telephone and Telegraph Company, are in honor of Frank B. Jewett, who retired in 1944 as vice-president of the company. Each fellowship is for one year, and carries a stipend of $3,000, with a further honorarium to the institution where the work is done. Primary consideration is given to the demonstrated research ability of the applicant, the fundamental importance of the problem he proposes to attack and the likelihood of his growth as a scientist.

DR. LAWRENCE W. DURRELL, head of the department of botany and plant pathology of Colorado College, has been appointed dean of the Division of Science. He will take up this work on July 1.

DR. ANDREW VAN HOOK, of the department of chemistry of Lafayette College, has resigned to become professor of chemistry at the University of Wyoming, where his time will be devoted mainly to research on the chemistry of sugar.

DR. SIDNEY C. MADDEN, associate professor of pathology at the School of Medicine of the University of Rochester, has been appointed professor of pathology and chairman of the department at the School of Medicine of Emory University. He succeeds Dr. Roy Kracke, who resigned last summer to become dean of the School of Medicine of the University of Alabama.

DR. KARL A. STILES, Bert H. Bailey professor of biology at Coe College, chairman of the Division of Natural Sciences, has been appointed associate professor of biology at Michigan State College, to take effect on July 1.

DR. W. ALBERT NOYES, JR., professor of physical chemistry at the University of Rochester, chairman of the Committee on the Professional Training of Chemists of the American Chemical Society, has been elected a regional director of the society representing the New York-New Jersey area to succeed Dr. Robert E. Wilson. Dr. Wilson was recently elected president of the Standard Oil Company of Indiana and has moved to Chicago.

DR. NATALE COLOSI, professor of bacteriology and public health at Wagner College and director of the Parkway Hospital, has been appointed a member of the New York Commission of the Interstate Sanitation Commission.

DR. GILBERT DALLDORF, since 1929 director of laboratories of Grasslands Hospital, Valhalla, Westchester County, N. Y., has been appointed director of the Division of Laboratories and Research of the New York State Department of Health to succeed Dr. Augustus B. Wadsworth, who has retired.

CAPTAIN WALTMAN WALTERS, formerly of the Mayo Clinic, Rochester, Minn., who returned recently from the South Pacific area, has been appointed chief of the division of surgery of the U. S. Naval Hospital at Philadelphia.

IT is reported in *Standardization* that Charles E. Wilson, president of the General Electric Company, has been appointed by the Secretary of Commerce to head a new committee to work with the American Standards Association and the Department of Commerce to make plans for a greatly expanded post-war program on national standards. Mr. Wilson returned to the General Electric Company recently, after having served as executive vice-chairman of the War Production Board. Other members of the committee are Frederick M. Feiker, dean of engineering, George Washington University; Clarence Francis, chairman of the board, General Foods Corporation; Ephraim Freedman, R. H. Macy and Company, Inc.; Frank B. Jewett, president, National Academy of Sciences; William B. Warner, president, McCall Corporation; Arthur D. Whiteside, president, Dun and Bradstreet, Inc., and R. E. Zimmerman, vice-president, U. S. Steel Corporation.

THE correct title of Dr. E. Cowles Andrus is "chief of the Division of Medicine under the Committee on Medical Research of the Office of Scientific Research and Development," not chairman of the Committee on

Medical Research, as given erroneously in a recent issue of SCIENCE.

A GRANT of $2,295 from the Office of Scientific Research and Development has made it possible to continue until June 30 the study of protein metabolism which has been under the direction of Professor Arthur H. Smith and Associate Professor John W. Hirshfeld, of Wayne University. This grant supplements the sum of $8,490 appropriated for the work from February 1, 1944, to January 31, 1945.

THE University of Oxford has received from the Rockefeller Foundation the sum of £1,200 for the year beginning March 1, for biological investigations of penicillin under the direction of Sir Howard Florey, professor of pathology.

DR. CRAWFORD H. GREENEWALT, technical director of the department of explosives of E. I. du Pont de Nemours and Company, has been appointed assistant director of the development department.

DR. CARL B. WOLF, since 1930 botanist at the Rancho Santa Ana Botanic Garden, Anaheim, California, has tendered his resignation effective about June 1. He expects to take over the management of the Sespe Land and Water Company at Fillmore, Calif. The company manages over 1,000 acres of land, of which approximately 400 acres are in lemons and oranges.

DR. HAROLD E. HIMWICH, professor of physiology and pharmacology at Albany Medical College, recently addressed the Osler Clinical Society, the students' organization at the School of Medicine of the University of Vermont, on "Hypoglycemia, its Physiology, Pathology, Symptoms and Treatment."

DR. ALLEN O. WHIPPLE, professor of surgery, Columbia University, will present the annual E. Starr Judd lectureship in surgery at the Medical School of the University of Minnesota on the evening of April 10. The title of the lecture will be "The Problem of Portal Hypertension in Relation to Hepatic-Splenopathies."

THE annual meeting of the Michigan Academy of Science, Arts and Letters, which was to have been held in Ann Arbor on March 16 and 17, has been cancelled. By action of the council, meetings probably will be discontinued for the duration of the war. The officers elected last year to serve through the current year will continue in office for an additional twelve-month period.

IN cooperation with the Office of Defense Transportation, the executive committee of the American Association of Cereal Chemists has passed a resolution cancelling the 1945 annual meeting of the association, which was scheduled for Toronto during the latter part of May. At the same time, the executive committee decided that this meeting will be postponed and held at approximately the same time and in the same place in 1946, providing that progress with the war and transportation facilities will permit. The committee further decided that the present officers should be continued in office until their successors have been duly elected according to constitutional procedure.

A FORUM of the New York Branch of the American Association of Scientific Workers will take place in the New York Times Hall, 240 West 44th St., New York City, on March 26 at eight o'clock in the evening. The speakers will include Dr. Harlow Shapley, director of the Harvard College Observatory; John E. Burchard, professor of engineering and director of the Albert Farwell Bemis Foundation of the Massachusetts Institute of Technology; Samuel J. Novick, president of the Electronic Corporation of America, and Lewis A. Berne, international president of the Federation of Architects, Engineers, Chemists and Technicians.

PLANS have been made, according to *The Washington Star,* for the establishment of the Science Society of Washington, the object of which is to contribute to scientific development in the Washington area through conducting a series of popular scientific lectures, promotion of junior scientific activities and sponsoring discussion groups on subjects of interest. Temporary officers have been elected as follows: Ware Cattell, of *The Washington Scientist, president;* R. B. Hobbs, of the National Bureau of Standards, *secretary;* Morris C. Leikind, of the Library of Congress, *treasurer,* and Murray Sagman, *manager of the membership drive.*

THE Cooperative Grange League Federation Exchange has made a gift of $200,000 to Cornell University for the erection of a building for the School of Nutrition, of which Dr. Leonard A. Maynard is director. The school was established in 1941.

The Experiment Station Record reports that gifts amounting to $26,400 have been made to the University of Wisconsin and its Experiment Station. These include $5,200 for an industrial fellowship in biochemistry to study the vitamin and amino acid content and nutritional value of meats; $3,300 for studies of the inactivation of milk by ultraviolet light; $3,300 for the utilization of waste sulfite liquor from paper mills; $1,600 on the effects of processing on meats and meat products; $2,200 on factors affecting the activity of dried brewers' yeast, and $2,000 for a study of the relationships between the nicotinic acid content of milk and its antipellagra qualities.

THE Radio Receptor Company, Inc., has placed a scholarship of $2,500 at the disposal of the department of physics of the Washington Square College of New York University. The recipient of this scholarship will be a student working for the doctorate and the research which the scholarship is designed to promote will be the subject of the thesis for the degree. Applications with credentials should be directed to the Chairman of the Physics Department, Washington Square College of Arts and Science, New York University, Washington Square, New York 3, N. Y.

A NEW du Pont postgraduate fellowship in chemistry has been made available for the academic year of 1945–46 to the Polytechnic Institute of Brooklyn. The list of applicants will not be closed for the next three months. The fellowship includes tuition paid by the du Pont Company in addition to a $1,000 stipend. It will be awarded for the fall term of 1945.

THE department of sociology of Oberlin College has introduced courses in general and cultural anthropology, origins of modern culture and racial and cultural minorities. The department of chemistry will include a new course in modern theories of organic chemistry, and the department of arts will give a course in museum training.

IT is reported in the *Journal* of the American Medical Association that on February 14 the Wisconsin Alumni Research Foundation filed in the U. S. District Court a reply denying all accusations of illegality and asserting that all actions were designed to safeguard the public interest and preserve legitimate royalty income. The filed reply is an answer to a Government suit charging monopoly, price fixing and other violations in connection with the marketing of patented vitamin D products. Litigation started about eighteen months ago, when the foundation sued the Douglas Laboratories, manufacturing chemists, for patent infringement. The Government intervened with a counterclaim against the foundation, and last October amended the counterclaim to include seventeen other defendants, naming one individual and ten food and drug companies.

INVESTIGATIONS into the use of new nitrogen containing compounds as agricultural fertilizers have been initiated for the American Cyanamid Company, in charge of W. P. Martin, assistant biochemist at the Agricultural Experiment Station of the University of Arizona. The company has made a grant-in-aid of $1,000 a year for three years. A search will be made for compounds that will supply the nitrogen, develop it slowly in the soil and that will contain nitrogenous material of such solubility that it will not leach rapidly to areas below the root zone of the plant.

THE Tropical Institute in Basel, Switzerland, is now established in a fully equipped building. Scientific studies affecting the tropics will be undertaken, and special training will be given to students who wish to go to the colonies.

IT is stated in *Nature* that the British Joint Council of Professional Scientists has been established for the period of the national emergency to voice the collective opinion of qualified men of science. It was originally a joint committee of representatives of the Royal Institute of Chemistry and of the Institute of Physics, which was set up for the purpose of fostering coordinated action in matters of common interest, and was developed by the cooption of a botanist, a geologist, a mathematician and a zoologist, there being no corresponding professional bodies to represent those branches of science. One of the representatives of the Royal Institute of Chemistry is a metallurgist of similar standing. The council has now been working for two years. Among matters which have received, or are receiving, its attention are the proposal to urge the Government to establish a central scientific and technical board; the Ministry of Labor's announcement regarding the minimum number of hours to be worked in laboratories and factories; the influence on professional standards of war-time university regulations governing the award of degrees; the conditions of service of professional men of science in the Colonial service and the national policy regarding research and development work.

DISCUSSION

THE CRUCIAL POSTWAR NEED FOR AN INTERNATIONAL, AUXILIARY LANGUAGE FOR THE SCIENCES

A PROBLEM which we should try to settle immediately concerns the common language that will be needed after the war if the results of research are to be made promptly and readily available to scientists of all nations. If this problem has been less critical in the past, it is because most scientists, regardless of nationality, have been trained in universities where either English, German or French is the primary language. But as scientific activities spread, more and more research workers will be trained at home—in Russia, Latin America, China, Japan—and we may find ourselves cut off from one another by language barriers. To effect economy of effort in learn-

ing secondary languages and, what is far more important, to help safeguard the international character of scientific activities, it seems essential that we immediately take steps to get an auxiliary, world language for the sciences into use.

The history of attempts to develop an international language is long, but it should suffice here to recall to mind two recent studies. In 1921 a committee of the British Association gave unanimous approval to the desirability of having an international, auxiliary language and reached the conclusion that an invented language, such as Esperanto, is more practicable than either a dead language or a modern one. In the same year, 1921, a similar committee of the American Association for the Advancement of Science recommended: (1) a searching, fundamental study of the principles involved and experimental data available; (2) authoritative international agreement, both as to linguistic details and as to the practical measures to be taken.[1]

Perhaps these committees would now modify their recommendations in the light of events since 1921. The demand for a world language has become more emphatic; indeed, a recent British Association committee on postwar education has recommended that every university should require its students to be able to speak and write an international language.[2] Much has also been done to clear up the theories and facts as suggested by the American committee. As for the recommendation that there be international agreement on some language, such action surely would come too slowly to be of much value for the immediate postwar years.

If the trends of the past two decades are taken into account, the present answer to the question of what the international, auxiliary language should be, clearly is *English*. Even before the present war the tendency was toward English in international commerce. Today, on account of the war, devices and materials originating in English-speaking countries are in use almost everywhere, with the result that numerous English technical and vocational terms are being added to many different languages that have no suitable equivalents or substitutes for them.

Compared with French or German, English has certain characteristics that make it the best language of the three for the sciences. Possibly English is not the ideal science language for all time to come, but it is the one language that can be gotten into fairly general use almost immediately. If this is not done, it will be the fault of scientists who write in English.

The procedure is absurdly simple. The first step is merely that authors and editors of abstracts and research papers, nothing else, become thoroughly conscious of all readers in their own fields, but in other countries, whose reading knowledge of English will be only moderate and not comparable with that of a scientist trained in a British or American graduate school. Although this simple step can be taken immediately, and will accomplish a good deal, there soon will be a demand for a basic vocabulary upon which all authors and readers can rely. Such a vocabulary, which must be developed by expert linguists, is already available in the system known as Basic English.[3] Moreover, this system, with its simplified grammar, has now been extended to provide basic vocabularies for the sciences, including mathematics.[4] Certainly all abstracts of technical papers should from now on be written in Basic English, and here the editors of scientific journals must take the lead.

It should be emphasized that the concern here is not in a general world language, but in an *auxiliary*, world language for the sciences. If there are valid reasons for not trying to get Basic English into use for this purpose, the writer is unaware of them.

Scientists have made contributions to language that are more fundamental than is generally appreciated;[5] and the present question of an international, auxiliary language clearly lies within their domain and can be settled more readily and effectively by them than by any outside group. However, any proposal requiring modifications in language habits is slow to take effect unless there is vigorous group action. Various organizations of scientists surely will try to reach some practical decision on this question of an international, auxiliary language and, for that matter, on any course of action that will help materially in the postwar years to preserve an international fellowship among scientists and the freest possible interchange of scientific knowledge.

DUANE ROLLER
WABASH COLLEGE

[1] S. W. Stratton, SCIENCE, 55: 166, 1922. This report also describes the work of the British Association committee.

[2] R. Gregory, *Nature*, 150: 622, 1942.

[3] C. K. Ogden, "The System of Basic English" (Harcourt, Brace, 1934). For a brief description of the system, see, for instance, Hugh Walpole, "Semantics" (Norton, 1941), Chapter 9.

[4] C. K. Ogden, "Basic for Science" (Kegan Paul, 1942).

[5] These contributions, as revealed by an analysis of physical science source literature, are discussed by the writer in "Technical writing and editing," *Am. Jour. Physics*, 13 (April, 1945), in press. The present note is a modified version of one section of that article.

THE THREAT TO PURE SCIENCE

IN his letter printed on December 8th, Mr. Eugene V. D. Robin discusses the subject of the value of science. He commends the kind of science that has "practical applicability," the kind that "will help greater numbers of men lead richer, fuller, more comfortable lives." He condemns, on the contrary, the kind of science practiced by the man who says, "Man-

kind go hang. I am looking for intellectual stimulation and personal satisfaction."

It is the purpose of this letter to suggest that Mr. Robin is here making a false antithesis. Disagreement does exist among modern scientists as to the value and significance of science, but the disagreement is confused by Mr. Robin's antithesis. On the one hand, there are scientists who regard science as existing solely for the part it can play in supplying the material wants of man. On the other hand, there are scientists who value science as an end in itself (without, of course, denying that it also serves man's material welfare if properly used). Those who lay stress on the immaterial or spiritual values of science do not say, "Mankind go hang." On the contrary, they consider that they serve mankind well in discovering truth. They believe that the establishment of truth, with its corollary, the disestablishment of falsehood and superstition, is one of the highest functions a human being can fulfil (apart altogether from the applications of discovery to material welfare). The scientist who pursues truth disinterestedly is only unsocial if he keeps his results secret after he has made sure of them, or if he only makes minor investigations when his mind is capable of work that would result in large generalizations (for if truth be good, then large truths expressed in generalizations are better than small, disconnected discoveries).

Any one who considers that it is mystical to consider truth a good in itself should ask himself what is the alternative belief. Mr. Robin writes of "richer, fuller, more comfortable lives." It is true that most men exercise their higher functions best when adequately nourished, properly sheltered from the elements and protected from disease, but when these conditions have been secured, what are they living *for*? Surely the whole of mankind can not be living *only* to nourish, shelter and protect others, so that these may do the same for yet others, in endless and senseless succession? Would it not be more sensible to suggest that art, music, literature and philosophy, for instance, are valid ends for which it is worth while to live? And if so, can it be denied that science, every bit as much as any of these, has intrinsic value? If art and music can help to make men and women live "richer, fuller" lives, can not science too? Mr. Robin's antithesis is false: the true antithesis is between those who adopt the crudely materialistic view and value nothing but what serves man's material wants, and those who believe on the contrary that science, with art, music and the rest, is an example of man's highest striving after a worth-while life.

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EPSOM SALTS AND NUTRIENT VALUE OF BERRIES

THE first instance of definite and profitable response from magnesium applied to Oregon soils was recently obtained by the Soils Department of Oregon Agricultural Experiment Station, in connection with fertility experiments with cane fruits. Treatments were made with gooseberries on Amity silty clay loam in connection with extensive fertilizer experiments that have been carried on since 1939. Application of 30 pounds per acre of magnesium sulfate, or Epsom salts, resulted in the maximum yield of gooseberries in 1944 in comparison with other treatments. The treatment improved cane growth and appearance of foliage, and the net profit was increased $62.25 an acre above the cost of the treatment.

Leaf blotch from lack of magnesium is similar to leaf scorch from potash deficiency. Where high applications of potash were made to overcome leaf scorch, there appeared to be a tendency to make the magnesium already in the soil less available to plants. Four plots receiving fertilizer supplying a medium amount of potash gave a net increase of $10.70 an acre from the treatment. The minor element plots had been given a blanket application of 500 pounds an acre of complete (5–15–20) fertilizer.

More than a decade ago, some western Oregon soils such as Veneta silty clay loam and Labish peat were found to be low in magnesium, yet profitable response from the use of magnesium-calcium carbonate as compared with calcium carbonate was not previously obtained. Field crops were previously used as indicator plants. Dolomitic limestone has been applied to four plots in two experiment fields, and sulfate of potash-magnesia is also to be tried.

Analyses by Dr. L. K. Wood in our soils laboratory show scorched leaves to be high in manganese when grown on our acid soils with no fertilizer. Gooseberry leaves from four out of a dozen fertilizer plots were near the indicated critical concentration of magnesium. While available magnesium in these soils is rather low, liming should precipitate and suppress manganese, and magnesium limestone may do this and also supply magnesia which is needed for chlorophyl.

The Vitamin C content of boysenberries from a plot treated with 40 pounds an acre of magnesium sulfate was found to be 24.4 per cent. above that of berries from an untreated check plot. This was 2.1 milligrams more per hundred grams than the fruits of any of nine other plots. Raspberries had 4 per cent. more vitamin C when grown on a plot treated with magnesium sulfate. These determinations were made with fruit grown on plots located on Powell silt loam. The determinations were made by Dr. J. R. Haag, assisted by Melvin Williams.

W. L. POWERS

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A POTENTIAL INTERMEDIATE HOST OF SCHISTOSOMA MANSONI

ALTHOUGH as close as the West Indies and parts of South America, schistosomiasis has never become established in the continental United States nor are there present in this country any of the known intermediate snail hosts of the three species of human schistosomes. Because of the possibility of the acquisition of schistosomiasis by troops serving in endemic areas abroad and the return of infected individuals to the United States, experiments are being carried out in this laboratory to determine whether domestic species of snails are capable of serving as intermediate hosts for these schistosomes. We[1] have already reported negative results following efforts to infect eleven species and subspecies of native snails with *Schistosoma mansoni*. Lest those results engender a false sense of security, it is deemed advisable to report promptly recent experimental evidence which indicates that the snail, *Tropicorbis havanensis*, is suitable for development of the intermediate stages of *S. mansoni*. Six juveniles of *T. havanensis* measuring about 3 mm in diameter were exposed to infection by adding on three occasions eggs and miracidia of *S. mansoni* to the water of the finger-bowl aquarium. Thirty-one days after the first exposure and 24 days after the last exposure schistosome cercariae were noted in the water. Only one of the 6 snails proved to be infected; from 1 to 16 emerging cercariae per day were observed on 12 of the ensuing 17 days.

The snails used in the experiment were laboratory reared progeny of specimens obtained through the cooperation of Drs. Harold Manter and Arlie Todd; they were collected by the latter from a lake at the edge of the campus of the Louisiana State University, Baton Rouge, Louisiana. They were identified as *Tropicorbis havanensis* (Pfeiffer) by Drs. H. A. Rehder and J. P. E. Morrison, of the U. S. National Museum. In the museum's collection, in addition to a considerable number of specimens from various localities in Cuba, there is one lot collected from Lake Pontchartrain, Louisiana, and another from near New Braunfels, Comal County, Texas.

It is hoped that this report will stimulate additional research with this and other species of *Tropicorbis*.

ADDENDUM.—Subsequently, of another lot of six *T. havanensis*, two additional specimens have been infected. The original infected snail is still shedding cercariae 52 days after they were first detected.

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CONCERNING THE PROPOSED WORD "ECHOLOCATION"

IN a recent article[1] the word "echolocation" is proposed to describe the process of locating obstacles by means of echoes of sounds emitted vocally or by special instruments.

Rather than introduce a new word it would seem better to use "echo-ranging" or "sound-ranging." These terms are definitive and have been in use for a number of years in underwater acoustics.

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SCIENTIFIC BOOKS

TELESCOPES

Telescopes and Accessories. By GEORGE Z. DIMITROFF and JAMES G. BAKER. ("Harvard Books on Astronomy.") 307 pp. 146 figures. Philadelphia: The Blakiston Company. 1945. $2.50.

To many persons the instruments and methods used in the study of the stars are fully as intriguing as the results of astronomical research. There is something mystical about a telescope that reveals the wonders of distant worlds. The present work gives an up-to-date popular description of the tools used by astronomers, and though written for the layman the book contains much valuable material for the professional student, and especially for the amateur who builds his own telescope and who is always interested in equipment and means beyond his reach.

The chapters on light and on the principles of the visual telescope give an expansion of the usual material in elementary text-books. Since so much astronomical work is done by photography there is a chapter on the photographic process. The discussion of photographic plates brings to mind the great debt astronomers owe to Dr. C. E. K. Mees, director of the Eastman Kodak Research Laboratories, for continued cooperation in furnishing the newest and best emulsions that can be made. During the past dozen years or so the advancement of observational astronomy has been even more a matter of new photographic plates than of instrumental improvements.

[1] E. B. Cram, M. Jones and W. H. Wright, *Proc. Helminth. Soc. Wash.*, 11: 64–66, 1944.

[1] Donald R. Griffin, SCIENCE, 100: 589–590, December 29, 1944.

Under photographic telescopes both reflectors and refractors are discussed, with emphasis on the Schmidt camera. It is a striking fact that as late as 1930 a really new form of telescope could be invented by Bernhard Schmidt, of Bergedorf, Germany. This telescope or camera consists simply of a spherical mirror and a thin correcting plate of glass placed at the center of curvature of this mirror, the combination fulfilling the contradictory requirements of both speed and wide field. Whereas the great reflectors have focal ratios of about f/5, the new Schmidt telescopes are as fast as f/2.5 or, in the smaller sizes, down to f/1. It appears that these instruments are springing up like mushrooms in the United States, with projected sizes up to a 72-inch mirror at Palomar and a 60-inch at Harvard. After the war we may expect that all the striking pictures of the star fields of the Milky Way, taken with five to ten-inch lenses, will have to be done over again with Schmidt cameras and red-sensitive plates.

The different attachments that go with telescopes, such as spectrographs and photometers, are well described, but the tyro will not always be able to distinguish between a currently active and an obsolete instrument, nor between the precision obtained, for instance, of radial velocities with the slit spectrograph and the objective prism.

In the elaborate instruments for solar research we come, strange to say, to the field of the amateur. The late Dr. George Ellery Hale once defined an amateur as one who works at astronomy because he can not help it. In his life-long study of the sun Hale himself remained true to this definition, always contriving new and more powerful apparatus, and toward the end he brought out the spectrohelioscope, a device within the means of amateurs and used all over the world. The McMath-Hulbert Observatory near Pontiac, Michigan, is another case where the amateurs have outdone the professionals. Here the first moving pictures of solar phenomena were taken, and various instrumental innovations such as the electrical driving of a telescope are copied to advantage by observatories elsewhere.

The large telescopes of the world are listed in the order of their size; sometime we may hope to have such a list in the order of their contributions to science. The late Professor Edward C. Pickering, when once asked if they had the largest telescope in the world at Harvard, replied: "No, but we probably have the smallest one that is doing useful work." It was in about 1900 that James E. Keeler with the Crossley reflector at the Lick Observatory demonstrated the possibilities of the reflecting telescope in a good climate. There are now in various countries some twenty-five telescopes larger than the 36-inch Crossley, but, measured by the product, not more than half a dozen are equal to it in efficiency and power. That more than mere size is involved is well stated by the authors:

> A telescope is more than a machine; it is an enterprise around which clusters the life of an institution. It is in a sense a never-ending development, born of the vision of the scientist who conceives it and the engineer who designs it; it assumes form in the hands of the builders, the mechanics, whose ability and skill contribute to the construction; and finally it is nursed by the observer, not altogether without affection, through many nights and years of service, continuously altered or improved as the years bring new technical developments or as new ways are found of using it more efficiently.

The book is well printed with many good illustrations, and the few errors inherent in a first printing do not detract from its value. It is a worthy member of the Harvard series, and, like the others, if a person has a copy, somebody else will soon be asking to borrow it.

JOEL STEBBINS

WASHBURN OBSERVATORY,
UNIVERSITY OF WISCONSIN

AQUATIC PLANTS

Aquatic Plants of the United States. By WALTER CONRAD MUENSCHER. 374 pp. 154 figs. 400 maps. Comstock Publishing Company. 1944. $5.00.

As Volume 4 of the series of handbooks of natural history issued under the editorial supervision of A. H. Wright, this book maintains the high standards of previously issued numbers. The author has the same difficulty experienced by Fassett in selecting material for his "Manual of Aquatic Plants" (McGraw-Hill, 1940). In range Muenscher is more catholic by covering the entire United States, though he excludes Canada. This wide coverage is a valuable feature of the book, since many visitors to Florida are interested and puzzled by the abundant aquatics there.

In the application of his definition of aquatic plants, Muenscher omits many (33) genera included by Fassett, and also fails to include conspicuous algae and bryophytes, as well as woody plants. In both books species are omitted (*e.g., Helonias bullata, Rhexia virginica, Rynchospora* spp., *Caltha natans*) which other botanists would have included. Muenscher with good reason avoids the trinomials and quadrinomials which cluster around the numerous named forms and varieties of such variable genera as Potamogeton. His failure to include synonyms is not so happy.

Families and genera are well defined. The excellent keys effectively replace the detailed descriptions of species usual in manuals.

The numerous illustrations are well drawn and reproduced, and with the keys make identification fairly

simple. Flavor is given the book by the wide field experience of the author, whose notes on habitats and distribution are especially good. A map gives at a glance the distribution of each species.

Those interested in aquatic plants, after feeling for a long time the need of a good manual, are now handsomely served by two authoritative and useful texts.

IVEY F. LEWIS

REPORTS

THE HARVARD COLLEGE OBSERVATORY[1]

TO THE PRESIDENT OF THE UNIVERSITY:

SIR,—I regret to record a disaster at sea—the loss of the S.S. *Robin Goodfellow* with its crew and its cargo of important materials for war industries. Apparently there had been engine trouble before the ship left port, and possibly a subsequent dropping-out of convoy. A relatively small item in the *Robin Goodfellow's* cargo, but large in the eyes of the Harvard Observatory, was a shipment of astronomical photographs on the way to Cambridge from the Observatory station at Bloemfontein, South Africa. The loss was totally unexpected. The insurance rates on transatlantic shipments had dropped to a very low figure, and our shipping advisers in South Africa and in America had assured us of the relatively high safety of shipments by sea. During the past several years we have made shipments once or twice annually from America to South Africa—shipments of photographic plates and of other materials necessary for the operation of the station; we have had very high insurance costs, but no losses whatsoever. For the past two years we had attempted no return shipments from South Africa. Large quantities of photographic negatives are accumulating in our southern storehouse. Only twice have we had to ration our plate-hungry telescopes for a few weeks or months while awaiting the replenishment of raw materials from England or the United States.

In number of photographic plates our loss by the sinking of the *Robin Goodfellow* is something less than 20 per cent. of a year's work. Notwithstanding the presumably low risk, we did, nevertheless, deliberately avoid shipping home the plates made with the patrol cameras. Photographs made with the Rockefeller reflector or the Bruce refractor can be replaced; but the essence of the patrol plates is their continuous coverage of the sky throughout the year, and time can not be replaced.

In looking over recent Annual Reports from the Observatory, one is struck by the failure to finish off jobs as pledged in the reports. This merely reflects our commendable optimism, when in full pursuit of a scientific project, and also the continually increasing drain by war projects on the personnel of the Observatory staff. The investigators are largely absent, and we do not have computers and other assistants to help carry through the routine researches in the Observatory's programs. For example, the Memorial Volume for Miss Annie J. Cannon, although essentially completed, remains unpublished. The Jewett telescope at Oak Ridge can not yet be put into regular operation. The discussion of the Milton Bureau's variable stars progresses slowly.

Although much delayed, because its authors are deeply involved in war work, the volume in the series of Harvard Books on Astronomy, entitled "Telescopes and Accessories," by Dr. George Z. Dimitroff and Dr. James G. Baker, is completed and within a few weeks of publication. The six earlier volumes in the series have continued to find new readers; four of them have required a second printing. An eighth volume in the series, not heretofore announced, will be entitled "The Relativistic Universe." It will be written by Dr. Phillipp Frank and an associate. The preparation of Dr. Menzel's volume on the Sun and solar problems must be postponed until the end of the war.

A text for courses in navigation was completed during the past year by Dr. Bart J. Bok and Miss Frances W. Wright. The volume, with the title of "Basic Marine Navigation," has been adopted by a large number of colleges and universities for their wartime courses in navigation. One of the important responsibilities of the Department of Astronomy during the past three years has been the giving of heavily attended courses in navigation for both the civilian and navy students in Harvard College.

During the past year, the Wyeth reflector at Oak Ridge has not been used, and there is little likelihood that it will be put into operation again until the return of the observing staff. The same is true of the Jewett reflector, which is of the Schmidt design. It has been tested mechanically and optically, and to the extent that we find it possible, further improvements in the guiding mechanism, the electric drive, and the plate-holder ensemble will be carried on during the coming year. Test photographs by Dr. Bok, with exposures extending up to two hours, demonstrate that the correcting plate, mirror and mounting are all highly satisfactory. The instrument will be able to add importantly to our studies of nebulae, variable stars, Milky Way structure and galaxies when regular

[1] Report of Dr. Harlow Shapley, Director of the Astronomical Observatory of Harvard College, for the year ending September 30, 1944. Cambridge, Mass., 1945.

operations can be resumed. Mr. Ralph Evans, who was formerly operator of some of the telescopes at Oak Ridge, is now involved in other operations; he writes of recent visits to Berlin and other German cities.

The supervision of the observational work at the Oak Ridge station has this year been largely the responsibility of Dr. Bok. The metagalactic surveys with the Metcalf refractor, as well as the systematic patrol of bright stars and bright meteors, and photometric and spectroscopic studies of the Milky Way, have been maintained. The Oak Ridge grounds suffered only slight damage from this year's hurricane. The maintenance of the work at the Climax Station of the Observatory, as at Bloemfontein, has met with personnel difficulties. But both Dr. Paraskevopoulos at the southern station, and Dr. Roberts at the Colorado mountain station, have maintained essentially full operation.

Working with nine photographic telescopes, the Boyden station staff made a new monthly record, 1,218 plates, for July, 1944. Only one night of the month was astronomically useless.

The study of solar phenomenon at Climax continues to yield results of exceptional interest, and we are continually reminded of the advisability of carrying through several developments of equipment and technique in the post-war era, in order that from this nearest of the stars we can enrich our knowledge, both of our own earth and of sunlike stars throughout the Milky Way.

During the past year I have published a revision of the distances of thirty of the globular star clusters and a new estimate of the thickness of the star haze surrounding the galactic system. The Gaposchkins have published, or completed for publication, several papers on interesting variable stars. Each month from the Observatory Dr. Bok issues a mimeographed Astronomical News Letter, which is distributed by the Department of State not only to the embassies and legations abroad for European astronomers, but also to something like a hundred American astronomers who are now away from their observatories and libraries. The material in these Astronomical News Letters comes in part from the astronomical literature of all countries, which we get hold of in one way or another, and in part it is prepared by the astronomers themselves in order to summarize for their colleagues the war-time progress in special astronomical fields. The Harvard Announcement Cards, which carry the "spot news" of astronomy, have been issued in considerable number during the year, notwithstanding the absorption of most American scientists in the war. They have reported Kuiper's discovery of an atmosphere of methane and ammonia on Titan, the large satellite of Saturn; Van Biesbroeck's finding of the star of lowest known candle power; Luyten's finding of a pair of white super-dense dwarf stars; and the discovery of comets by observers in Finland and New Zealand. Harvard's contribution to these discoveries has been only in the providing of some photographic material for others to examine, in the checking of the existence or the motion of some of the comets, and in the routine distribution of the astronomical information.

HARLOW SHAPLEY, *Director*

SPECIAL ARTICLES

THE RHESUS GENE AND THE EFFECT OF CONSANGUINITY

IT is well known that consanguinity increases the proportion of homozygotes. Consequently, individuals homozygous for a recessive gene are found to have a higher proportion of parents who are closely related to each other than the average proportion of close consanguinity for the whole population. Since in general only genes with unfavorable effects stand out sufficiently to become objects of single factor analysis, it has been said, correctly, that marriages between near relatives tend to be unfavorable to the offspring. While such a statement is generally modified by the remark that recessive genes with favorable effects should also be more frequently homozygous in the children from consanguineous unions, no case of such a nature has actually been observed.

There is, however, a human disease of peculiar genetic causation which should be less frequent in offspring from consanguineous marriages. This is caused by the so-called Rh gene. When a mother homozygous for the recessive gene r^1 is pregnant with a child of the heterozygous genotype Rr, it happens in a certain proportion of cases that an antibody originates or already exists in the mother's blood against the R-antigen in the blood of the fetus and that diffusion of the antibody into the circulation of the fetus causes erythroblastosis foetalis, a hemolytic condition often fatal. The genetic prerequisites for the parents of the affected child are that the mother be rr and the father either RR or Rr. Thus, the parents must be of different constitution. Since the

[1] Following R. R. Race, G. L. Taylor, F. W. Ikin and A. M. Prior, *Annals of Eugenics*, 12: 206–215, 1944, the symbols R and r will be used instead of Rh and rh. Furthermore, in the following discussion, all alleles which give a positive reaction with one or more R antisera will be jointly labelled R, in contrast to the allele r which does not cause a positive reaction with any R antiserum.

probability of consanguineous parents being of different constitution is less than that of non-consanguineous parents, marriages between near relatives should result in erythroblastosis less frequently than unselected marriages.

An approximative value of this effect will be calculated for first cousin marriages: Let p be the frequency of the r allele in the population, q that of the R allele ($p+q=1$), and k be a constant denoting the proportion of erythroblastosis actually occurring in cases where the genetic prerequisites regarding the constitution of mother and child are present. The frequency of the disease in the offspring of first cousin marriages can be determined after answering: What is the probability of the cousin of an rr woman being either Rr or RR? If, in Fig. 1, No. 7 is rr, her

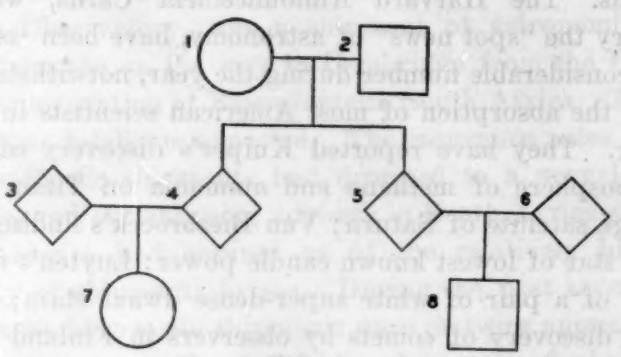

FIG. 1

parent No. 4 must at least have carried one r allele. In this case the two parents of No. 4, namely No. 1 and No. 2, must have carried jointly at least one r allele, while for each of the three other alleles carried by No. 1 and No. 2 the probability of its being r or R is p or q, respectively. Since individual No. 5 obtains a random sample of two of the four parental alleles and transmits only one of these two alleles to No. 8, this latter individual has a chance of one quarter of obtaining any one of the four grandparental alleles. Thus, the total probability of No. 8 inheriting r from No. 1 and No. 2 is one quarter of the certainty, 1, of their possessing one r allele plus three times one quarter of the probability, p, of any of the other three alleles being r:

$$\tfrac{1}{4}+\tfrac{3}{4}p=\tfrac{1}{4}(1+3p)$$

The probability of No. 8 inheriting R from No. 1 and No. 2 is zero for the certain r allele of the grandparents plus three times one quarter of the probability, q, of any of the three other alleles being R:

$$\tfrac{3}{4}q$$

Considering, that the mate No. 6 of No. 5 will transmit R and r to No. 8 in the proportions q and p, the probabilities of the possible genotypes of No. 8 become

$$\text{rr}: \frac{p}{4}(1+3p)$$

$$\text{RR}: \tfrac{3}{4}q^2$$

$$\text{Rr}: \frac{q}{4}(1+3p)+\tfrac{3}{4}pq=\frac{q}{4}(1+6p)$$

The probability of obtaining erythroblastotic children from a mating of No. 8 with the rr cousin, No. 7, is the sum of the probability of No. 8 being RR and one half of that of No. 8 being Rr, times the constant k:

$$k\left[\tfrac{1}{4}q^2+\tfrac{1}{8}q(1+6p)\right]=\tfrac{1}{8}kq$$

Thus, cousin marriages in which the female partner is rr should produce only $\frac{1}{8}$ of the incidence of erythroblastosis as compared with marriages of rr women to non-related men.

If x is the frequency of cousin marriages in the population, the frequency of erythroblastosis in the offspring of cousins is

$$\tfrac{1}{8}k\cdot x\cdot p^2\cdot q \qquad (1)$$

The probability of the disease in non-related marriages is

$$k(1-x)\cdot p^2\cdot q$$

which for small values of x becomes

$$k\cdot p^2\cdot q \qquad (2)$$

The proportion of cousin marriages among the parents of all erythroblastotic children is, using (1) and (2)

$$\frac{\tfrac{1}{8}k\cdot x\cdot p^2\cdot q}{\tfrac{1}{8}k\cdot x\cdot p^2\cdot q+k\cdot p^2\cdot q}$$

which reduces to

$$\frac{x}{x+8/7} \qquad (3)$$

Table 1 gives the values of this expression for various frequencies of cousin marriages. The table shows

TABLE 1

EXPECTED PER CENT. FREQUENCY, e, OF FIRST COUSIN MARRIAGES AMONG THE PARENTS OF ERYTHROBLASTOTIC CHILDREN FOR VARYING VALUES OF PER CENT. FREQUENCY x OF COUSIN MARRIAGES IN THE GENERAL POPULATION

x	.1	.3	.5	.8	1.0
e	.0874	.262	.436	.695	.868

the expected decrease in the number of cousin marriages giving rise to erythroblastosis as compared to the respective assumed value, x, for cousin marriages in the general population. The amount of the difference is not very large, being about 13 per cent. in the whole range of frequencies of cousin marriages as found usually in European and American populations.

A more accurate analysis of the situation would have to take into account, besides other corrections, the fact that among the children of the pairs No. 1 and No. 2, No. 3 and No. 4, and No. 5 and No. 6, fatal cases of erythroblastosis occur. In populations with $q>p$ this further decreases the probability of No. 8 obtaining an R gene from No. 1 or No. 2. Since, however, the incidence of erythroblastosis in its various clinical aspects is only a small fraction of that genetically expected, and since only approximately one half of the affected children die, a factor k^1 for selective mortality introduced into the calculation

would be of the order of .01 and would not appreciably alter the values obtained from the above treatment.

It is doubtful whether differences as small as those calculated in Table 1 could be discovered in the available data of erythroblastosis. Nevertheless, an investigation of the incidence of cousin marriages among the parents of erythroblastotic children and among their maternal grandparents would be of interest, since it is conceivable that it might uncover a higher incidence in either the parents or maternal grandparents or in both than in the general population.[2] If such a higher frequency were found, it would indicate that rare recessive genes on other loci than the R locus share responsibility for the appearance of the disease. If the parents of erythroblastotic children should show an abnormally high incidence of consanguinity, recessive genes concerned with anatomical or physiological properties of the fetus and its membranes would be implied. If the maternal grandparents were consanguineous in an abnormally high frequency, recessive genes concerned with properties of the mother would be suggested.

SUMMARY

It is pointed out that consanguinity among the parents of children affected by erythroblastosis foetalis should be less than in the general population, unless other loci than the R locus are involved in the disease.

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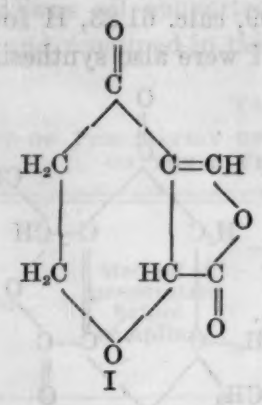
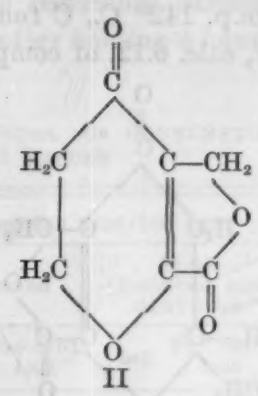
THE SYNTHESIS OF A CLAVACIN ISOMER

A NUMBER of investigators have isolated antibiotic substances from *Aspergillus clavatus*,[1,2] *Penicillium claviforme*,[3] *Penicillium patulum*,[4] *Penicillium expansum*[5] and *Aspergillus giganteus*,[6] which were subsequently found to be identical.[7,8] This mold metabolite has been named clavacin, claviformin, clavatin and patulin. Raistrick[4] *et al.* investigated the chemistry of this product and on the basis of degradation products gave it structure I.

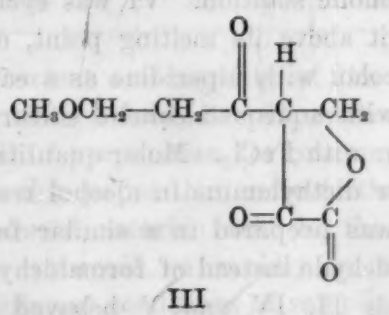


I



II

The possibility that tautomerism exists between Formula I and II led us to attempt the synthesis of II. Recently Bergel[9] *et al.* suggested such a tautomerism in order to explain certain of their results on the degradation of clavacin. Prior to the appearance of the publication by Bergel and co-workers we had synthesized compound II in the following manner: ethyl oxalate was condensed with 3-ketobutyl methyl ether in the presence of sodium methoxide to give ethyl-2,4-diketo-6-methoxy caproate, b.p. 124–126° C., 7–8 mm. This product was condensed with aqueous formaldehyde in the presence of an equivalent of alkali to give β-methoxypropionyl-ketoparacone of structure III, m.p. 126° C., C found 51.68, 51.48, calc. 51.61, H found 5.86, 5.50, calc. 5.38.



III

The same product was obtained when methyl vinyl ketone was condensed with ethyl oxalate in the presence of sodium methoxide, followed by the condensation of the resulting sodium salt with formaldehyde.

By treatment of Compound III with 20 per cent. sulfuric acid, methyl alcohol was eliminated to give anhydro-3-hydroxymethyl-5,6-dihydro-γ-pyrone-carboxylic acid-2 (II), m.p. 87° C., C found 54.74, 54.45, calc. 54.55, H found 4.03, 4.01, calc. 3.90.

The ultraviolet absorption spectrum of II has a single maximum at 2,760 Å, the same as clavacin[10] (I), but its intensity ($E^{1\%}_{1\ cm.}$ 613.2) is lower than that of clavacin ($E^{1\%}_{1\ cm.}$ 900–1400[10]).

[2] Data compiled by M. T. Macklin, *Am. Jour. of Diseases of Children*, 53: 1245–1267, 1937, will have to be enlarged before any conclusion can be drawn.

[1] B. P. Wiesner, *Nature*, 149: 356, 1942.

[2] S. A. Waksman, E. S. Horning and E. L. Spencer, SCIENCE, 96: 202, 1942; *Jour. Bact.*, 45: 233, 1943.

[3] E. Chain, H. W. Florey, M. A. Jennings, *Brit. Jour. Exp. Path.*, 23: 202, 1942.

[4] H. Raistrick, J. H. Birkinshaw, A. Bracken and S. E. Michael, *Lancet*, 2: 625, 1943.

[5] W. K. Anslow, H. Raistrick and G. Smith, *Jour. Soc. Chem. Ind.*, 62: 236, 1943.

[6] H. W. Florey, M. A. Jennings and F. J. Philpot, *Nature*, 153: 139, 1944.

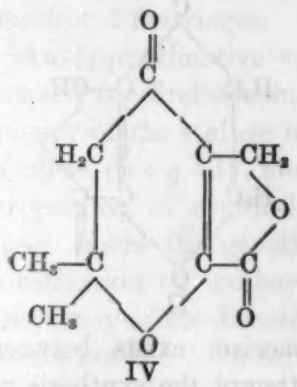
[7] F. Bergel, A. L. Morrison, A. R. Moss, R. Klein, H. Rinderknecht and J. L. Ward, *Nature*, 152: 750, 1943.

[8] I. R. Hooper, H. W. Anderson, P. Skell and H. E. Carter, SCIENCE, 99: 16, 1944.

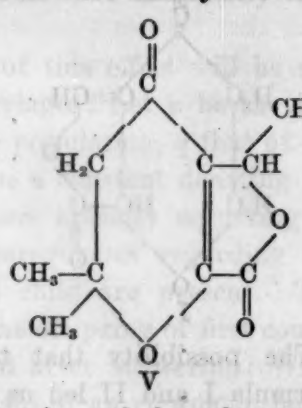
[9] F. Bergel, A. L. Morrison, A. R. Moss and H. Rinderknecht, *Jour. Chem. Soc.*, p. 415, 1944.

[10] P. A. Katzman, E. E. Hays, C. K. Cain, J. J. Van Wyk, F. J. Reithel, S. A. Thayer, E. A. Doisy, W. L. Gaby, C. J. Carroll, R. D. Muir, L. R. Jones and N. J. Wade, *Jour. Biol. Chem.*, 154: 475, 1944.

Two homologues, IV, m.p. 85° C., C found 59.48, 59.36, calc. 59.33, H found 5.82, 5.77, calc. 5.53, and V, m.p. 142° C., C found 60.99, calc. 61.23, H found 6.27, calc. 6.12, of compound II were also synthesized.

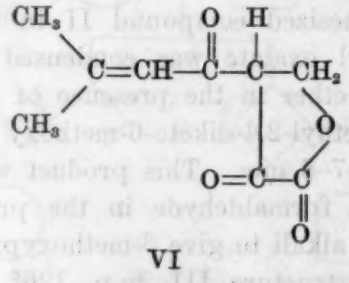


IV



V

IV was obtained by condensing ethyl oxalate with mesityl oxide in the presence of sodium methoxide and reacting the resulting sodium salt with formaldehyde to form VI, m.p. 150° C.



VI

This product gave a deep red color with $FeCl_3$ in aqueous alcoholic solution. VI was cyclicized to IV by heating it above its melting point, or by refluxing it in alcohol with piperidine as a catalyst, or by heating it with aqueous-alcoholic sulfuric acid. IV gave no color with $FeCl_3$. Molar quantities of sodium methoxide or diethylamine in alcohol reconverted IV to VI. V was prepared in a similar fashion to IV using acetaldehyde instead of formaldehyde.

Compounds II, IV and V behaved similarly to clavacin in that on treatment with dilute alkali and reacidification, they gave a deep red coloration with $FeCl_3$. This most probably is due to the opening of the pyrone ring, similar to the conversion of IV to VI, using sodium methoxide or diethylamine. Excess of alkali opens the lactone ring and leads to the formation of sodium oxalate and other degradation products.

IV is very stable towards dilute acids, even on boiling for a considerable length of time. When tested against *Staphylococcus aureus in vitro* compound II showed a slight bacteriostatic action in a dilution of 1:2000; IV, V and also III were inactive; VI had bacteriostatic activity in a dilution of 1:4000.

Katzman *et al.*[10] and Bergel *et al.*[9] have shown that clavacin on catalytic hydrogenation at atmospheric pressure takes up from 3–4 moles of hydrogen. We have found that compound IV takes up only 1 mole of hydrogen using palladium charcoal, Raney nickel or platinum oxide at 300 pounds pressure. The double bond in the pyrone ring was not reduced under these conditions, but a practically quantitative yield of anhydro-3-hydroxymethyl-5,6-dihydro-6,6 dimethyl-4-hydroxy-pyrone-carboxylic acid-2, m.p. 122° C., was obtained. This product was reconverted in good yields to IV by oxidation with chromic acid.

Our syntheses of compounds of type II and the study of their properties show that these compounds do not enter into the dynamic tautomerism suggested by Bergel *et al.*[9] for clavacin. The existence of the two isomeric forms, I and II, is comparable to the existence of the α- and β-forms of angelica lactone. Attempts to effect a rearrangement of compounds of type II to compounds of the clavacin type (I) have thus far been unsuccessful.

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THE EFFECT OF MACERATION OF FOODS UPON THEIR ASCORBIC ACID VALUES

THE methods of assay of foods for their ascorbic acid content, which have been recommended by the Committee on Vitamin Assay Methods of the National Cooperative Experimental Project on the Conservation of the Nutritive Value of Foods, stress the importance of correct sampling and the necessity of stopping the destructive action of the enzymes naturally present in certain plant foods by quickly extracting the ascorbic acid in a 3 per cent. meta-phosphoric acid solution. Although attention has been called to the fact that some of the ascorbic acid in foods may be present in the reversibly oxidized (also biologically active) form which is not measurable by the dye reduction method, the error from this source has not generally been considered serious.

Recently in this laboratory, however, the error under some conditions has been found to be of great magnitude. In a study of the vitamin A and C values of certain kinds of melons[1] we encountered considerable variation in the ascorbic acid content of different samples taken from the same melon. In an attempt to obtain more representative, homogeneous samples, the edible portions of whole cantaloupe were cut and 50-gm samples of the macerated material were taken for analysis. We were surprised to find that the ascorbic acid when analyzed by the usual method for the reduced form appeared to have been completely destroyed. When, however, H_2S was bubbled through a portion of the meta-phosphoric acid ex-

[1] M. C. Smith, H. Farrankop and E. Caldwell, *Mimeo. Rept.* No. 67, Arizona Agricultural Experiment Station.

TABLE 1

REDUCED AND DEHYDROASCORBIC ACID IN CANTALOUPE BEFORE AND AFTER MACERATION*

	Ascorbic acid mg/100 gm		
	Reduced	Total	Per cent. dehydro
Before maceration	49	51	4
After maceration	0	49	100
After maceration and holding 4 hours	0	41	100

*1 minute in Waring Blendor.

tract, following the method of Bessey,[2] it was found that almost all the ascorbic acid was still present but was in the reversibly oxidized form. The conversion was evidently catalyzed by the presence of ascorbic acid oxidases, for when the cantaloupes were steamed before they were macerated, the ascorbic acid remained in the reduced form.

The dehydroascorbic acid which had been so quickly formed when the melon cells were ruptured was evidently itself much more slowly changed to a biologically inactive substance. After holding the raw macerated material in which all the ascorbic acid was in the dehydro form for 4 and 24 hours, the loss in total ascorbic acid was only 16 and 35 per cent., respectively.

The possibility that conversion of reduced to dehydroascorbic acid may occur in raw vegetables when prepared for consumption, as quickly as it did in melons when macerated, suggested itself. As recently reported in SCIENCE,[3] "In many mess halls vegetables and fruits are finely minced." The losses in ascorbic acid which resulted in 30 minutes and 2 hours after mincing with steel or plastic knives or in the "Buffalo" chopper were reported. Although it was stated that "analyses were run by the method of Bessey,"[2] whether total ascorbic acid or the reduced form only was determined is not clear.

From our data, as shown in Table 2, it appeared that when apples, celery, cucumbers, peppers and radishes were chopped as is commonly done when they are served in salads, or when the juice was extracted as in Health Food Stores, a high percentage of the reduced ascorbic acid which had disappeared was still present in a biologically active form. Although some of the dehydroascorbic acid was destroyed on standing 4 or 24 hours, the losses were relatively small. When potatoes were boiled a loss in reduced ascorbic acid occurred as expected, but the action of ascorbic acid oxidase which catalyzes the conversion of the reduced to the dehydro form had obviously been inhibited. When ripe tomatoes were sliced, or their juices expressed, then ascorbic acid remained in the reduced form. The opposite was true for *green* tomatoes, for their ascorbic acid when juiced was all converted to the reversibly oxidized form and remained in this form after holding 4 hours.

[2] O. A. Bessey, *Jour. Biol. Chem.*, 126: 771–784, 1938.

[3] C. M. McCay, M. Pijoan and H. R. Taubken, SCIENCE, 99: 454–5, 1944.

TABLE 2

EFFECT OF PREPARATION OF RAW FOODS FOR CONSUMPTION ON THEIR VITAMIN C VALUES

Food	Method of preparation before sampling	Ascorbic acid/100 gm			
		Reduced		Total (Reduced and dehydro)	
		mg	Per cent. loss	mg	Per cent. loss
Apples	Uncut	3	...	5	...
	Chopped	0	100	5	0
	Juice	0	100	5	0
Celery	Uncut	8	...	12	...
	Chopped	5	38	12	0
	Juice	0	100	9	25
Cucumbers	Uncut	9	...	13	...
	Chopped	5	44	12	9
Peppers (green)	Uncut	70	...	77	...
	Chopped	38	46	74	4
	Juice	0	100	60	22
Potatoes	Uncut	30	...	32	...
	Chopped	3	90	28	13
	Boiled	21	30	24	25
	Boiled and mashed	10	67	14	55
Radishes	Uncut	28	...	31	...
	Chopped	19	32	29	10
Tomatoes (red)	Uncut	16	...	19	...
	Sliced	16	0	19	0
	Juice	16	0	19	0
(green)	Uncut	16	...	20	...
	Juice	0	100	20	0

Evidently the extent and rapidity of the conversion varied greatly with a food, its pH, enzymes present and the method of preparation for consumption.

The data in this paper thus indicate that the conversion of reduced ascorbic acid to the reversibly oxidized form proceeds so rapidly in some foods under many different conditions of sampling, holding, and preparation for consumption, and is frequently of such magnitude, that the usual method of assay of the reduced form *only* is an inadequate measure of the true vitamin C values if dehydroascorbic acid may be considered only slightly less active as an antiscorbutic than the reduced form.

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THE EXPERIMENTAL TRANSMISSION OF PINTA, MAL DEL PINTO OR CARATE TO THE RABBIT[1]

MOOSER, Varela and Vargas,[2] León-Blanco,[3] Briceño Rossi and Iriarte[4] and Lieberthal[5] tried, unsuccess-

[1] From the Instituto de Enfermedades Tropicales y Parasitología "Carlos Finlay," University of Habana:

fully, to infect laboratory animals with *Treponema carateum,* the causal agent of pinta, mal del pinto or carate.

Curbelo and collaborators[6] were able to produce keratitis and orchitis, respectively, in rabbits, utilizing as inoculum material obtained from a Cuban case of pinta, but the lesions by them described were not wholly characteristic, and could have been produced by banal microorganisms or by *Treponema pallidum.* The latter possibility must be the more seriously considered, since León-Blanco demonstrated that the cutaneous syndrome known as pinta in Cuba may be caused by both *Treponema carateum*[7] and *Treponema pallidum.*[8]

In this preliminary note we report the results obtained at the beginning of a series of experimental studies started with the object of differentiating between the pinta-like cutaneous syndrome produced by *T. pallidum* (and which constitutes a still undetermined proportion of what in Cuba is known as "pinta") and true pinta, mal del pinto or carate, a well-defined nosologic entity produced by a specific treponeme: *Treponema carateum,* Brumpt 1939 or *Treponema herrejoni,* León-Blanco 1939.

Material and methods: One of us (A. O.) saw in December, 1943, the patient L. M., a Jamaican negress, 47 years old, who presented a keratotic, dyschromic skin condition affecting the palms and soles, accompanied by intensely positive Kahn and Meinicke reactions, and diagnosed clinically as pinta, mal del pinto or carate. We could easily demonstrate treponemata in the skin lesions by means of the technique recommended by one of us.[3]

In order to prove conclusively the cause of this patient's illness, we inoculated on January 4, 1944, a volunteer (A. A.), in the anterior aspect of the left forearm, with serous fluid expressed from the dyschromic lesions, utilizing the technique one of us (F. L. B.) has introduced for the experimental transmission of pinta, mal del pinto or carate from man to man. At each of the two points of inoculation there appeared the initial lesions of pinta, and in these the presence of treponemata could readily be demonstrated.

The initial lesions have continued to progress, and at the time of writing the first efflorescence of pintids has appeared, *i.e.,* the first lesions of the stage of general spread of the disease. This experimental proof shows beyond the shadow of a doubt that our patient, L. M., had pinta, mal del pinto or carate, and not syphilis.

On February 18, 1944, we obtained a few drops of serous fluid by compression of the initial lesions of A. A., and dark-field examination showed the presence in the fluid of *Treponema carateum.* The fluid, diluted with 0.4 cc of normal salt solution, constituted the inoculum. With a syringe and needle of the kind used for the Mantoux tuberculin test we inoculated four black rabbits intradermally in the scrotum, as superficially as possible, with 0.1 cc for each animal.

Results: The rabbits were examined at weekly periods. June 13, 1944, 105 days after inoculation, there was visible in one of the rabbits, at the very point of inoculation, a pink papule that grew slowly to a diameter of 8 mm. June 23, 1944, 115 days after inoculation, the summit of the papule presented a circular superficial erosion 5 mm across; the erosion was covered by a dark scab. Upon lifting the scab several droplets of bloody serum oozed from the base of the erosion, and in this fluid we found numerous treponemata by dark-field examination; they stained easily with the Fontana-Tribondeau method.

Four additional rabbits were inoculated on June 24, 1944, with the serous fluid from the eroded papule of the above rabbit, but to this date no lesions have appeared. In order to identify the treponemata observed in the eroded scrotal papule of the rabbit we inoculated that same day (June 24, 1944) a second volunteer, D. D., in the skin of the volar aspect of the left forearm. A traumatic inflammatory reaction developed at the point of inoculation, but this disappeared in 72 hours. July 7, 1944, 13 days after inoculation, a rounded zone of erythema, 2 mm across, was noticed at the point of inoculation. July 17 the zone of erythema was slightly infiltrated and somewhat papular. It grew slowly, and by August 17, 1944, had the appearance of an ovoid papule measuring 6 by 4 mm in principal diameters; the surface was finely scaly. On August 10, 1944, we expressed a few drops of serous fluid from the papule and demonstrated by dark-field examination numerous treponemata that were easily impregnated with the Fontana-Tribondeau method. Because of the manipulations necessary to obtain the serous fluid, D. D.'s initial lesion at present shows slight ulceration that is undergoing healing. The rabbit's eroded papule began to heal, and disappeared completely on July 12, 1944, at which time the

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Director: P. Kourí. Abstracted from a preliminary note read before the Cuban Society of Biology, Tropical Medicine and Parasitology on August 17, 1944.

[2] H. Mooser, G. Varela and L. Vargas, *Bol. inst. hig.,* 2: 224, January, 1936.

[3] F. León-Blanco, *Rev. med. trop. y parasit., bact., clin. y lab.,* 6: 5, January–February, 1940.

[4] A. L. Briceño Rossi and D. R. Iriarte, *Bol. lab. clin. l. razetti,* 4: 221, March, 1944.

[5] E. P. Lieberthal, *Jour. Am. Med. Asn.,* 123: 619, November, 1943.

[6] A. Curbelo *et al., Rev. cienc. med.,* 1: 134, October, 1938.

[7] F. León-Blanco, *Arch. soc. est. clin. hab.,* 35: 165, March, 1941.

[8] F. León-Blanco and L. Beausoleil, *Arch. soc. est. clin. hab.,* 38: 257, January–February, 1944.

scab dropped off spontaneously. The papule has been converted into a nodular infiltration the size of a grain of corn, which we are continuing to observe closely.

Comments: Patient L. M. undoubtedly had pinta, mal del pinto or carate, as shown by the inoculation of volunteer A. A., in whom the initial lesions of pinta, mal del pinto or carate were produced at each one of two points of inoculation. In the present state of our knowledge the only laboratory method that will allow with certainty to differentiate syphilis from pinta, mal del pinto or carate is the experimental inoculation of man, with the production of an initial pinta lesion different from that of syphilis and pian.

The ulcerative papular lesion produced in one of four rabbits inoculated with serous fluid obtained from the initial pinta lesion of volunteer A. A. resulted from the inoculation of *Treponema carateum* and not from some other species of treponema, since subpassage to volunteer D. D., utilizing serous fluid expressed from the ulcerated papule of the rabbits, resulted in the development of an initial pinta lesion that contained abundant treponemata.

Summary: In this preliminary note we describe the results obtained by inoculation of the skin of the scrotum of four black rabbits with serous fluid expressed from an initial pinta lesion. The inoculation was made intradermally, as superficially as possible, with serous fluid rich in treponemata and diluted with normal salt solution. A papule appeared at the point of inoculation in one of the four rabbits on the 105th day. One hundred and fifteen days after inoculation the papule presented a circular erosion on an indurated base. The serous fluid expressed from this lesion contained numerous treponemata on dark-field examination, and these were easily impregnated by the Fontana-Tribondeau method. A volunteer inoculated with serous fluid expressed from the rabbit's lesion developed a typical initial pinta lesion at the point of inoculation, thus proving that the scrotal lesion of the rabbit was produced by *Treponema carateum* or *Treponema herrejoni,* the causal agent of pinta, mal del pinto or carate.

Four rabbits inoculated with serous fluid from the scrotal lesion of the rabbit have not yet developed visible lesions.

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THE PROTECTION OF PANCREATIC LIPASE BY ACACIA GUM

DURING a series of experiments on the enzymatic activity of pancreatic lipase, it was found that the presence of the acacia gum had a pronounced effect in preventing the destruction of the enzyme. An emulsion consisting of 1 ml tributyrin plus 1 gm of acacia gum plus 100 ml of water buffered to a pH of 8.8 was the substrate used in these experiments. The substrate was added to 80 mg of fat-free pancreatic lipase. The reaction was allowed to proceed at constant temperature in a water bath. The mixture was agitated constantly by means of an electric stirrer. To measure the pH a glass and a calomel electrode were placed in the mixture and connected to an electronic null indicator and potentiometer. The mixture was maintained at constant pH by adding sodium hydroxide at short

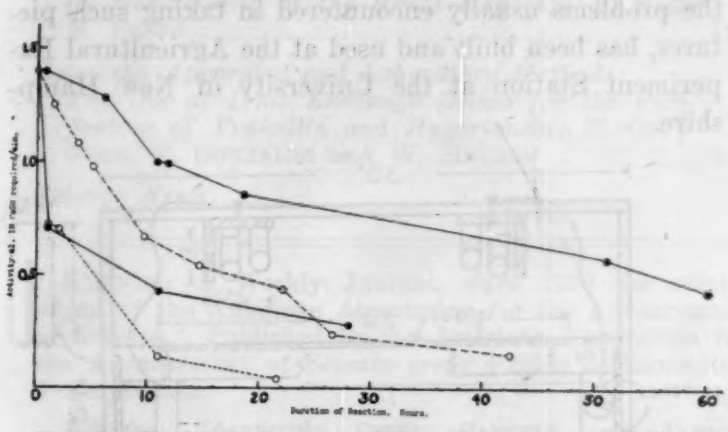

FIG. 1. Residual lipase activity after pancreatic lipase was in solution with various substrates for different periods of time. Upper Curves: Enzyme with tributyrin with gum ————. Enzyme with tributyrin without gum - - - - - - - -. Lower Curves: Enzyme with gum without tributyrin ————. Enzyme in buffer without gum and without tributyrin - - - - - - - -.

intervals of time. The reactions were allowed to proceed for varying durations from forty minutes to sixty hours. To determine the amount of enzyme activity remaining after each period an emulsion containing 10 ml of tributyrin was added and the rate of the reaction followed for at least fifteen minutes. The velocity of this hydrolysis was taken as a measure of the residual enzyme activity.

The following controls were also run: substrates of tributyrin with no acacia gum, gum plus enzyme with no tributyrin, and enzyme without gum and without tributyrin. Fig. 1 shows the results of these experiments. It may be seen that the enzyme deteriorates most rapidly in the absence of gum and tributyrin and that the presence of gum without tributyrin protects the enzyme to a large extent. In the emulsions containing tributyrin the presence of gum further protects the enzyme from destruction. One experiment in which 40 gms of gum were used instead of 1 gm a rate of 1.3 ml of 1N NaOH per minute after 615 minutes of enzyme action was obtained. This represents only a slight enzyme deterioration.

The mechanism by which the gum protects the enzyme is at present unknown, but Mendel and Rudney[1] have recently discovered that acacia gum and

[1] B. Mendel and H. Rudney, SCIENCE, 100: 499, 1943.

other negatively charged colloids will restore the activity of true cholinesterase. It will be of great interest to determine how effective acacia gum may be in protecting other enzyme systems. Such work is at present in progress.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A LIGHT BOX FOR TAKING PHOTOGRAPHS IN BLACK AND WHITE OR COLOR

FOR photographing plants to show disease symptoms a light box (Fig. 1), which overcomes many of the problems usually encountered in taking such pictures, has been built and used at the Agricultural Experiment Station at the University of New Hampshire.

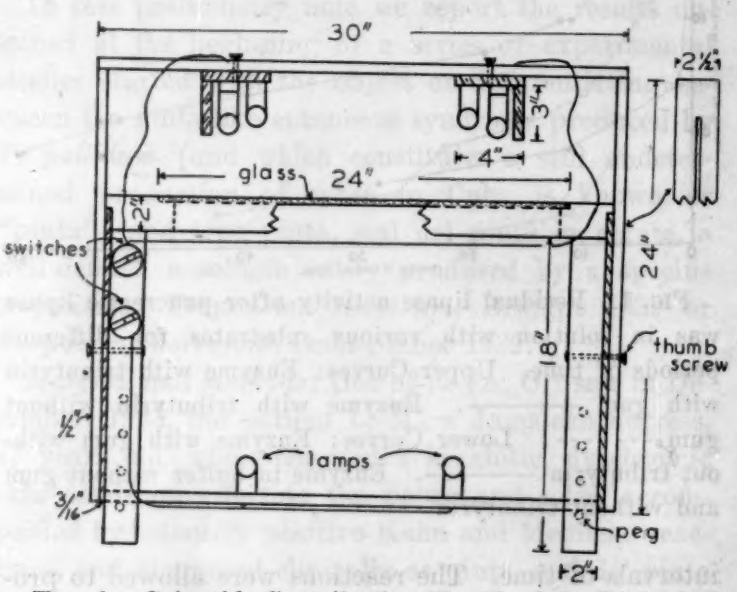

FIG. 1. Scientific Contribution No. 12 of the Biological Institute of the University of New Hampshire.

The box, except for the legs and frame supporting the glass, is made of five-ply (½ in.) and three-ply (3/16 in.) wood as shown. A cover 29 × 29 × ½ in. is used to cover the glass when the box is not in use. The box is painted white inside and varnished on the outside with a light oak stain.

By releasing the thumbscrews on the sides, the frame holding the top-lights may be raised or lowered, the bolts sliding in the grooves in the frame. The top-light reflectors may be moved in or out to fit the object.

Six unmounted General Electric light kits composed of the following parts were mounted directly to the wooden reflectors and base and controlled by the two switches: fluorescent T8 daylight lamp, 15 watt, 24" long; No. 58G670 auxiliary; No. FS2 starter; No. 7019HH, No. 7013HH sockets.

An opal glass 24 × 24 in. flashed on both sides is supported by the 2 × 3 × 29 in. frame, the frame being grooved so that the glass is flush with the wood on the upper surface. The base holding the two bottom lights is adjusted by moving the pegs shown. The camera is mounted above the box on an adjustable frame attached to the wall.

The daylight setting on the photometer, held at the camera lens, is used to determine the exposure for the type of film employed. Regular Kodachrome is used with the fluorescent lamps, thus avoiding the use of filters or shifting to type A Kodachrome which would be necessary if tungsten or photoflood lamps were used. Since the heat from the lamp is negligible, plant specimens and the operator do not wilt during the working period.

With the bottom lights on, the opal glass gives a white background without shadows for specimens up to 20 inches wide.

In photographing mosaic leaves or leaf variegations, the top-lights are moved up and outward or the bottom lights may be moved toward the glass to increase the light transmitted through the lighter areas of the leaf to give greater contrast.

Filters and filter factors may be used as with daylight. Pan X film and a Wratten A (No. 25) filter have given excellent contrast in photographing Halo-blight lesions on bean leaves and raspberry leaf mosaic.

When a black background is desired, a piece of black velvet cloth is placed over the glass with the bottom lights turned off. In photographing specimens with Kodachrome, a large 24 × 24 in. blue blotter may be placed on the glass to give a blue background which to some workers is more pleasing than white for certain plant specimens.

In photographing objects, such as apples or tomatoes, reflection of the lights on the fruits is obtained. This is not objectionable in color photographs as it adds life to the pictures. In black and white, however, it can be avoided by fastening a very thin piece of tissue paper over the lights.

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